


B O S T O N - B O U V É
C O L L E G E O F
H U M A N D E V E L O P M E N T
P R O F E S S I O N S



1981-1982
Graduate Programs
Northeastern University

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P R O F E S S I O N S



Graduate Programs

Northeastern University

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Introducing Boston-Bouvé College of Human Development Professions

The new Boston-Bouvé College of Human Development Professions was created in July 1980 when Northeastern University's Board of Trustees voted to approve a faculty-supported merger between the University's Boston-Bouvé College and the College of Education.

Ten separate departments are united by the merger. Each offers its own degree programs related to specialized and professional areas of study, but each shares with the other departments a common interest in educational service and a dedication to the concept of life-long education and the care and instruction of young and old, able and handicapped. For the ten departments brought together in Boston-Bouvé College of Human Development Professions, the merger expresses physically a unity that had always existed philosophically.

Studying in the Graduate School

The Graduate School of Boston-Bouvé College of Human Development Professions is one of eight graduate and professional schools at Northeastern. It offers more than seventy different programs of study leading to the master's degree, the certificate of advanced graduate study (CAGS), and the doctoral degree, all designed to help meet the needs and interests of professionals in a variety of educational, health-care, and community settings. In addition, the Graduate School offers nondegree certification and licensure programs in various teaching areas.

Students may enroll in Boston-Bouvé Graduate School on a full- or part-time basis, although international students on student visas must enroll full time. Part-time students usually elect one or two courses per academic quarter and can complete master's or CAGS requirements in two or three years. With careful planning, full-time students may be able to complete these same programs in one year.

Boston-Bouvé Graduate School schedules classes to offer students the maximum convenience and flexibility. Classes meet once weekly for twelve weeks in the fall, winter, and

spring quarters and twice weekly during the six-week summer quarter. All classes are scheduled during the late afternoon and evening hours or, occasionally, on Saturdays, at the main campus in Boston as well as at other accessible locations.

Programs of Study

The programs of study offered by the Graduate School of Boston-Bouvé College of Human Development Professions are listed below in alphabetical order according to degree. Some major areas of study permit students to select from concentrations within the area or to further specialize by pursuing study options available within concentrations. Where indicated by an asterisk (*), programs require the Miller Analogies Test (MAT) scores for admissions consideration; all other programs require the Graduate Record Examination (GRE) scores. Refer to the appropriate page(s) for specific information regarding individual programs.

Nondegree Certification Program

For elementary and secondary school teachers

Nondegree Licensure Programs

Moderate Special Needs

Severe Special Needs

Master of Education Programs

School and College Counseling

Elementary School Counseling

Secondary School Counseling

Career Development and Cooperative Education

College Counseling

Industrial Counseling

Student Personnel

Community Mental Health Counseling

Curriculum and Instruction

Adult Literacy

English-Language Arts

General Academic

Instructional Technology

Reading

Science-Mathematics

Social Studies

Early Childhood Education

- Administration

- Teaching

Educational Administration

- School Administration

- Occupational and Career Education Administration

Educational Research

Human Development

*Rehabilitation and Special Education

- *Rehabilitation Administration

- *Rehabilitation Counseling (including specialization in Deafness)

- *Moderate Special Needs

- *Early Childhood Handicapped

- *Severe Special Needs

- *Special Education Community Personnel

Social Sciences

Speech-Language Pathology and Audiology

- Audiology

- Speech Pathology

Master of Science Programs

Physical Education

- Administrative and Curricular Studies

- Administration and Supervision

- Curriculum and Instruction

- Exercise Sciences

- Athletic Training

- Cardiovascular Health and Exercise

- Kinesiology/Biomechanics

- Movement Behavior

- Adapted Physical Education

- Sports Studies

- Motor Learning and Development

Physical Therapy

- Cardiopulmonary Physical Therapy

Recreation and Leisure Studies

- Recreation Management

- Therapeutic Recreation

Certificate of Advanced Graduate Study (CAGS) Programs

Counselor Education

- Pupil Personnel Services Administration

- School Psychology

- Counseling
 - School
 - College
 - Community Mental Health
 - Family Systems Therapy
- Curriculum and Instruction
 - Adult Literacy
 - English Education
 - English-Language Arts
 - Instructional Technology
 - Reading
 - Science-Mathematics
 - Social Studies
- Educational Administration
 - Cooperative Education Administration
 - Higher Education Administration
 - Instructional Technology Administration
 - School Administration
 - Special Education Administration
- *Rehabilitation
 - *Rehabilitation Counseling
- Social Sciences

Doctor of Education Programs

- Leadership: Administration and Supervision
 - Counselor Education
 - Pupil Personnel Administration
 - Student Personnel Administration
- Educational Administration
 - Cooperative Education Administration
 - Higher Education Administration
 - School Administration
 - Special Education Administration
- Rehabilitation Administration

Master of Education, Master of Science, and Certificate of Advanced Graduate Study Programs

General Information

Admissions

An applicant for the Master of Education or Master of Science degree or Certificate of Advanced Graduate Study must have earned a bachelor's or master's degree, respectively, from an accredited institution and complete all admissions procedures as described below.

The following material must be on file in the Boston-Bouvé Graduate School offices before consideration will be given to any application:

1. Complete application form
2. Official transcripts from all colleges or universities attended
3. Three references
4. Statement of goals
5. An official copy of the Graduate Record Examination (GRE) scores or, for applicants to programs offered by the Department of Rehabilitation and Special Education, a copy of the Miller Analogies Test (MAT) scores
6. For applicants whose native language is not English, an official copy of the results of the Test of English as a Foreign Language (TOEFL)

International students are also required to submit an Educational Chronology form and a Declaration and Certification of Finances form.

7. \$25 application fee (nonrefundable)

Boston-Bouvé Graduate School may require a preadmission conference with any applicant.

The graduate school has a rolling admissions policy in most programs. Students may apply for admission in any quarter—fall, winter, spring, or summer—with the exception of applicants to programs in the Departments of Counselor Education (summer and fall only) and Speech-Language Pathology and Audiology (fall only).

The Admissions Office for Boston-Bouvé Graduate School is open Monday through Friday from 8:30 a.m. to 4:30 p.m. for personal interviews. Applicants wishing to discuss educational and career plans may call 617-437-2708 to make an appointment with the Coordinator of Admissions.

Special Departmental Admissions Requirements

Teacher certification is a prerequisite for programs in the areas of curriculum and instruction, early childhood education, school administration, and education for teachers of children with moderate special needs. Students not holding certification may enroll in a combined program.

Students applying to graduate programs in the areas of physical education, recreation and leisure studies, and speech-language pathology and audiology should have earned bachelor's degrees in the same area of study. Lacking this requirement or a specific number of courses in the area, students are expected to complete some undergraduate courses as specified by the individual department concerned.

Students applying to the program in physical therapy must have graduated from an undergraduate program approved by the American Physical Therapy Association.

Other special departmental requirements are discussed, where appropriate, in the information on specific departmental programs.

Full-Time Study

Full-time students must take a minimum of eight quarter hours of course work in all quarters. Enrollment in additional courses in any quarter must be approved by the student's adviser.

Part-Time Study

A part-time student may enroll in a maximum of two courses in any given quarter.

Special Students

Applicants who have earned a bachelor's degree from an accredited institution and do not wish to pursue a graduate degree may be accepted as special students. Applicants for special-student status must complete an application form and submit an official transcript indicating the highest degree earned together with a \$25 nonrefundable application fee.

Special students are part-time students and may take no more than two courses per quarter.

Special students who are later accepted into degree programs in Boston-Bouv  Graduate School may apply a maximum of twelve credits earned in study as a special student toward

fulfilling degree requirements, provided the courses are applicable to their programs. Special students may be considered for degree programs only upon full presentation of application materials as described for master's degree or CAGS programs (page 8).

Time Limitations

Course credits earned in the program of graduate study or accepted for transfer are valid for a maximum of seven years from the time taken to completion of degree requirements.

Academic Requirements

Students must complete a minimum of forty-eight quarter hours of course work in order to qualify for the Master of Education and Master of Science degree or the Certificate of Advanced Graduate Study. Students are expected to maintain a B (3.000) average in their course work; only eight (8) quarter hours of additional course work, including repeated courses, may be allowed to satisfy the B (3.000) average required for the degree. Students who receive a grade of F or U in a course must make up the course according to their adviser's recommendation. In no case are students permitted to repeat a course more than once.

Basic M.Ed. Degree Requirements

One course in Research Design

Two courses, chosen from an approved list in consultation with an adviser

A minimum of three graduate courses offered outside the student's major department

Basic M.S. Degree Requirements

One course in Statistics

One course in Research Design

66.890 Thesis/Project I

66.891 Thesis/Project II

Qualifying and Comprehensive Examinations

Master's degree candidates may be required by a department to take a comprehensive examination. Unsatisfactory performance in such an examination constitutes grounds for withholding the degree.

CAGS students may be required to take a qualifying examination. Some CAGS students are required to satisfactorily complete a comprehensive examination in order to qualify for the certificate.

Transfer Credit

A maximum of twelve quarter hours (nine semester hours) of credit obtained at another institution may be accepted toward the master's degree and the certificate of advanced graduate study, provided that the credits are recommended for transfer by the student's adviser, consist of work taken at the graduate level for graduate credit at an accredited institution, carry grades of A or B, and have not been applied toward any other degree.

Students desiring transfer credit should petition the Director of Boston-Bouvé Graduate School, in writing, by completing the necessary form obtainable from the Graduate School office or the faculty adviser. The completed form must be submitted to the Director of the Graduate School together with an official transcript and an excerpt from the catalog describing the course(s) for which transfer credit is requested. No transfer-credit request form will be considered complete without the signature of the student's adviser or department chairperson. Grades on transfer credits may not be used for the purpose of obtaining the academic average necessary for completion of degree requirements.

Students are informed in writing when transfer credit is officially awarded.

Course Descriptions

Course descriptions are available in the academic departments and in the Graduate School office.

Program Descriptions

Programs in Counselor Education

The Department of Counselor Education offers master's degree and CAGS programs to students interested in working in schools, higher education, community mental health agencies, hospitals, and industry.

M.Ed. Programs

At the master's level, specialized fieldwork settings and course work enable students to concentrate in the areas of school counseling, college counseling, community mental health counseling, career development and cooperative education, student personnel services, or industrial counseling.

Sample Program

Basic M.Ed. Requirements

Department Core Course Requirements

- 53.800 Philosophical Foundations of Guidance and Human Services
- 53.801 Tests and Test Procedures
- 53.804 Counseling Theory and Process
- 53.805-6 Counseling Practicum

One of the following:

- 53.813 School Counseling Strategies
- 53.814 Vocational Counseling Strategies
- 53.815 Rehabilitation Counseling Strategies
- 53.816 Psychological Counseling Strategies

Specialization Core Course Requirements

School Counseling

- 53.810 Elementary School Guidance
- 53.802 Vocational Development and Occupational Information
- 53.824 Individual Intelligence Testing

College Counseling

- 53.814 Vocational Counseling Strategies
- or
- 53.816 Psychological Counseling Strategies
- 53.809 The College Student and The Campus

Career Development and Cooperative Education

53.802 Vocational Development and Occupational Information

53.814 Vocational Counseling Strategies

Student Personnel Services

53.809 The College Student and The Campus

53.814 Vocational Counseling Strategies

53.812 Seminar in Student Personnel Work

Community Mental Health Counseling

53.808 Group Counseling

53.811 Family and Parent Counseling

53.807 Organization and Administration of Guidance

53.818 Case Studies in Marriage and Family Counseling

53.821 Psychoeducational Prescriptions

53.830 Seminar in Contemporary Issues in Counseling

53.831 Advanced Group Counseling

Industrial Counseling

53.811 Family and Parent Counseling
or

56.983 Rehabilitation of the Alcoholic
and Drug Dependent

Three courses in human resource management

Department Electives (selected from Community Mental Health Counseling courses)

The Counseling Practicum sequence (53.805-6) is always specific to the particular concentration to which the student has been admitted. Including the concurrently required counseling course (53.804), the sequence is offered only on a sequential basis beginning in the fall quarter. Part-time students may not begin this sequence until their second year of study and must apply for practicum placement by April 1 of the spring preceding practicum placement. Field site supervisors have the option of accepting or rejecting recommended students for placement.

During their practicum year, students should expect to spend two days (twelve hours) weekly at their practicum sites between October 1 and June 15. With special permission, some students may be able to use their places of employment as practicum sites, provided arrangements for supplementary experience are made with their advisers.

CAGS Programs

CAGS programs in Counselor Education are available in the major areas of Pupil Personnel Services Administration, School Psychology, Counseling (School, College, Community Mental Health), and Family Systems Therapy (Modular Program).

Students whose master's program in counselor education lacked a practicum are required to take Counseling Practicum 53.805-53.806 in addition to the minimum course requirements described below. Students with master's degrees in fields other than counseling are required, if otherwise admissible, to make up a minimum of five courses from the master's program, generally requiring at least two years to complete CAGS requirements.

All CAGS Counselor Education students are required to complete a full year of advanced fieldwork in the area of their specialization: 53.840-1 Advanced Fieldwork. In addition, they must also take 53.838 Psychodiagnostic Measures and, with the exception of School Psychology majors, 53.834 Advanced Theories of Behavior Change, as well as specialization and elective courses. Pupil Personnel Services Administration students select specialized courses from the Departments of Counselor Education and Educational Administration.

The full programs for all CAGS candidates must be carefully planned in consultation with academic advisers before course registration.

Concentration in Family Systems Therapy (Modular Program)

Students interested in developing a specialized competence in family systems therapy should select the modular program option. An intensive six-course sequence, accompanied by two advanced fieldwork courses, it is designed to promote an in-depth understanding of general systems psychological concepts and procedures as they are employed in family therapy.

Course enrollments in this program are limited to eighteen students per module. Students are required to have significant experience in the counseling field in order to qualify for the program and must make a commitment for two consecutive years as part-time graduate students.

Concentration in School Psychology

Offered jointly by the Department of Counselor Education and the Department of Psychology in the College of Arts and Sciences, the CAGS program in School Psychology is designed

for students interested in careers as school psychologists. In accordance with present Massachusetts certification requirements, the program is structured to assist students in developing the professional competencies necessary for providing direct, specific, and practical assistance to students, classroom teachers, parents, and other school personnel. Course offerings reflect areas of study that include learning theory, counseling strategies and interviewing, psychodiagnosis, remediation, special education, curriculum, organizational development, school structure, psychopathology, and human development.

Applicants to the program are interviewed by members of both departments concerned and, in addition to meeting regular CAGS admission requirements, must have at least thirty-two quarter hours (twenty-four semester hours) of undergraduate work in psychology as well as a master's degree in a psychology-related field in order to be considered for the program. Students admitted to degree candidacy are assigned an adviser from either the Department of Counselor Education or the Department of Psychology to work with them in planning a program of study.

Two years of field experience as a school psychology trainee under the supervision of a certified school psychologist are required.

Sample Program

53.843-4	School Psychology Fieldwork
51.870	Developmental Reading and Writing or
51.871	Reading and Language Disabilities I
56.840	Psychology of Individuals with Special Needs
19.822-3	Psychopathology I and II
53.836	Psychodiagnosis with Children and Adolescents
53.821	Psychoeducational Prescriptions
53.820	Seminar in School Psychology

Personality and Development Courses (two)

Elective(s)

Programs in Curriculum and Instruction

The Department of Curriculum and Instruction offers master's degree and CAGS programs designed to help students meet certification requirements of the Commonwealth of Massachusetts. Appropriate for certified or experienced teachers who wish to study instructional leadership and curriculum development, the programs may also benefit individuals who wish to have the opportunity to expand their professional backgrounds in subject matter or teaching skills by completing advanced degrees in their own or related fields.

Individuals lacking undergraduate teaching degrees may wish to enroll in the Department's nondegree certification program to meet teacher certification requirements before continuing in a regular master's degree program.

M.Ed. Programs

Master's degree programs in Curriculum and Instruction are available in the following areas:

- Adult Literacy
- Early Childhood Education
- English-Language Arts
- General Academic
- Instructional Technology
- Reading
- Science-Mathematics
- Social Studies

Sample Programs

Basic M.Ed. Requirements

Curriculum and Instruction Core Courses

- 51.880 The Evolution of Curriculum Theory and Practice
- 51.881 Seminar in Curriculum: Alternative Designs
(not required in Reading)

Specializations

Adult Literacy

- 51.870 Foundations of Reading
- 51.871 Reading and Language Disabilities I
- 51.872 Literature and Materials Seminar
- 51.920 Methods and Materials in Adult Literacy
- 51.923 Adult Literacy Clinic I
- 51.925 Adult Literacy Clinic II

Early Childhood Education

- 56.848 Early Childhood Learning Problems:
Identification and Program Development
- 93.801 Seminar in Early Childhood Education Theory
and Practice
- 93.802 Practicum in Early Childhood Education I
- 93.803 Practicum in Early Childhood Education II
- 53.804 Counseling Theory and Practice
- 53.811 Family and Parent Counseling
or
- 56.835 Socio- and Psychodynamics of Family Life

English-Language Arts

- 51.842 The English-Language Arts Curriculum
- 51.843 Literature in the English-Language Arts
Curriculum
- 51.844 Writing in the English-Language Arts
Curriculum
- 51.848 Language in the English-Language Arts
Curriculum
- 51.849 Topics in the English-Language Arts
Curriculum

General Academic

- 51.870 Foundations of Reading
- 51.871 Reading and Language Disabilities I
- 51.837 Curriculum Problems in Science and
Mathematics Education
- 51.838 Seminar in Science and Mathematics Teaching
- 51.853 History and the Social Sciences in the School
Curriculum
- 51.854 Social Science Materials Seminar

Instructional Technology

Courses selected in consultation with adviser

Reading

- 51.870 Foundations of Developmental Reading
- 51.871 Diagnosis and Remediation of
Reading/Language Disabilities I
- 51.872 Literature and Materials Seminar
- 51.873 Clinical Practicum in Reading
- 51.874 Diagnosis and Remediation of
Reading/Language Disabilities II
- 51.875 Field Practicum in Reading
- 51.877 Language and Reading
- 51.893 Seminar in Supervision of Reading/Instruction

Science-Mathematics

- 51.837 Curriculum Problems in Science and Mathematics
- 51.838 Seminar in Science and Mathematics Teaching
- 51.839 Implementing Change in Science and Mathematics Education

Social Studies

- 51.851 Seminar in Current Issues in the Social Studies
- 51.853 History and the Social Sciences in the School Curriculum
- 51.854 Social Science Materials Seminar

Electives (chosen in consultation with adviser)

Other Purposes

Students who wish to specialize in curriculum and instruction in a field not included in the above list have the opportunity to work with a faculty adviser who will assist them in developing an appropriate course of study drawn on offerings available throughout Northeastern's graduate schools.

CAGS Programs

The Department of Curriculum and Instruction offers two program options leading to the CAGS. Students who wish to study curricular and instructional alternatives and instructional supervision should select Option I, while students who want further study in their specialized areas and in the subject of instructional alternatives should select Option II, currently offered jointly with the Department of English in the College of Arts and Sciences.

Sample Programs

Option I

Curriculum and Instruction Core Courses

- 51.881 Seminar in Curriculum: Alternative Designs
(51.880 Evolution of Curriculum Theory and Practice is prerequisite.)
- 51.882 Seminar in Instruction: Alternative Designs
- 51.883-4 Seminar in the State-of-the-Art and Field Project

Electives (chosen according to major area of study)

Electives (chosen in consultation with adviser)

Option II

Curriculum and Instruction Core Courses

51.882 Seminar in Instruction: Alternative Designs
(51.800 Principles of Teaching, or equivalent,
is prerequisite.)

51.883-4 Seminar in the State-of-the-Art and Field Project

Curriculum and Instruction Electives

English Courses (minimum of six)

Programs in Educational Administration

The school administrator occupies a highly strategic position for influencing the central functions of teaching and learning. To help improve the quality of educational leadership, the Department of Educational Administration offers preparatory and continuing graduate programs at the master's and CAGS level for students who are interested in careers in administration, leadership, and supervision in an educational setting.

M.Ed. Programs

Three distinct programs are available at the master's level in the field of educational administration: elementary and secondary school administration, administration of occupational and career education, and early childhood administration. Courses of study emphasize the roles of individuals in positions such as assistant principal, principal of a small school, department chairperson, special program director, or beginning administrator in an allied field.

Sample Program

Basic M.Ed. Requirements

Departmental Course Requirements

- 52.810 Leadership in Education, Part I
- 52.811 Leadership in Education, Part II
- 52.813 Instructional Leadership: Curriculum
Development and Supervision

Specialized Courses in Area of Concentration

- Administration of Secondary School
- Administration of Elementary School
- Administration of Early Childhood Education

Administration of Occupational and Career Education
Administrative Internship (in appropriate setting)

Electives

Satisfactory completion of an oral conference and a written final comprehensive examination are also degree requirements of this program.

CAGS Programs

At the CAGS level, five administrative programs are available to applicants who have demonstrated a strong background in the special field of study at the master's degree level. Options for concentration include Cooperative Education, Educational Administration, Higher Education, Special Education Administration, and Instructional Technology.

Sample Program

Departmental Core Courses

- 52.830 Current Issues in Administration
- 52.831 Innovation and Change
- 52.832 Process of Administration
- 52.865 Systems Theory in Education

Specialized Courses in Area of Concentration

- Administration and Supervision of Special Education
- Administration of Cooperative Education
- Administration in Higher Education
- Educational Finance
- School Administration
- School Community Relations
- School Law
- Administrative Internship (in appropriate setting)

Electives

Satisfactory completion of a written final comprehensive examination is a requirement of this program.

Programs in Foundations of Education

The Foundations of Education Department offers Master of Education programs in the areas of Human Development and Educational Research.

Human Development

The Human Development program is designed to provide opportunities for practicing and prospective educators and human

services professionals to expand their knowledge and understanding of human development in its psychological and social aspects. The program offers a theory background for persons teaching, or planning to teach, psychology and behavioral science in secondary and elementary schools as well as for persons dealing with varied client populations in health- and service-oriented or recreational agencies.

Sample Program

Basic M.Ed. Requirements

Human Development Requirements

- | | |
|--------|--------------------------------------|
| 50.806 | Psychology of Learning |
| | or |
| 50.811 | Psychology of Thinking |
| 50.810 | Psychology of Personality |
| | or |
| 50.805 | Personality and Social Structure |
| 50.808 | Seminar in Child Development |
| 50.809 | Seminar in Adolescent Development |
| 50.819 | Theories of Developmental Psychology |

Electives (Four courses, chosen in consultation with an adviser, which may include a thesis)

Educational Research

This program offers professional training for individuals who are interested in careers in government, industry, or educational agencies or who wish to prepare for further study at the doctoral level. It is designed to help students acquire the skills of competent researchers by helping them develop 1) an understanding of the nature and characteristics of educational and social quantitative research as it is carried out in research agencies; 2) a basic knowledge of research methodology and related theory enabling them to assist at all stages of such research; and 3) the technical skill to carry out independently the operational aspects of research.

The culminating component of the program is the planning, executing, and written summarization of research for a thesis, intended as a small-scale, but usually original, investigation into a problem in education or related fields.

Sample Program

Basic M.Ed. Requirements

Research Requirements

- | | |
|--------|--|
| 50.841 | Introduction to Educational Statistics |
|--------|--|

- 50.842 Intermediate Educational Statistics
- 50.817 Advanced Research Design
- 50.847 Introduction to Computer Programming:
FORTRAN IV
- 50.891 Thesis (equivalent to two courses)
or
- 50.845-6 Independent Research Seminars I and II

Electives (three)

Programs in Physical Education

Students enrolled in Master of Science programs in Physical Education may select from three areas of concentration, each of which offers various options permitting further specialization. In addition to the basic M.S. requirements, students must complete twelve quarter hours within one of the three areas of concentration and twenty quarter hours of elective courses. Two of the five elective courses must be outside the basic area of concentration.

Concentration in Administrative and Curricular Studies

Graduate study within this concentration provides the opportunity for students who would like to study the concepts and techniques of efficient management as well as supervision and leadership strategies to design a program in *Administration and Supervision*. The *Curriculum and Instruction* option is designed to focus on curriculum and instruction theory, concepts of curriculum and instruction development, and evaluation theory. Students selecting this option within the concentration should be certified and have some experience as teachers of physical education.

Sample Program

Basic M.S. Requirements

Specialization Courses (12 q.h.)

- 62.810 Administration of Physical Education and Athletics
- 62.830 Curriculum Development in Physical Education
- 62.833 Applied Evaluation in Curriculum and Instruction
- 62.835 Seminar in Curriculum and Instruction
- 62.840 Advances in Instructional Concepts
- 62.872 Comparative Physical Education
- 66.805 Planning and Developing Facilities for Physical Education and Recreation

- 66.814 Supervision of Professional Personnel
- 66.886 Critical Thinking and Evaluation in Physical Education and Recreation and Leisure Studies

Electives (20 q.h.)

Concentration in Exercise Sciences

Students selecting this concentration have the opportunity to focus on the scientific bases for human motion with corresponding application in one of three options: Athletic Training, Cardiovascular Health and Exercise, or Kinesiology/Biomechanics.

The *Athletic Training* option offers a program of study in the care and prevention of athletic injuries, conditioning, and rehabilitation and includes the course work necessary for National Athletic Trainers Association certification as an athletic trainer. Undergraduate course work in adapted physical education and athletic training are necessary. (Required courses in this option: 62.857, 62.859)

Students selecting the *Cardiovascular Health and Exercise* option have the opportunity to develop expertise in assessing the physical fitness and cardiovascular health status of adults, prescribing exercise, and organizing and administering effective preventive health and exercise programs. (Required courses in this option: 62.855, 62.865, 62.866)

The *Kinesiology/Biomechanics* option focuses on the anatomical and mechanical phenomena which underlie human movement and is designed to assist students in learning a systematic approach to the analysis of motor skills activities and exercise programs. (Required courses in this option: 62.851, 62.852)

Sample Program

Basic M.S. Requirements

Specialization Courses (12 q.h.)

- 62.851 Anatomic Kinesiology
- 62.852 Mechanical Analysis of Sport
- 62.854 Physical Fitness Appraisal and Guidance
- 62.855 Exercise in Cardiovascular Health and Disease
- 62.857 Trauma Diagnosis and Treatment in Sport
- 62.859 Rehabilitation from Injury in Sport
- 62.865 Electrocardiography
- 62.866 Laboratory in Exercise Testing and Prescription

Electives (20 q.h.)

Special prerequisites apply to this program. See page 31.

Concentration in Movement Behavior

The focus of study in the Movement Behavior concentration may be in Adapted Physical Education, Motor Development and Learning, or Sports Studies.

The *Adapted Physical Education* option emphasizes practical and theoretical aspects of movement programs and their management for special-needs individuals. Students selecting this option should have undergraduate backgrounds in motor learning and development as well as in adapted physical education. (Required courses in this option: 62.842, 62.845)

Sports Studies focuses on the historical, philosophical, and psychosocial aspects of sport and physical education. (No specific specialization requirements)

The *Motor Learning and Development* option has as its focus the relationship between age changes and the development of movement control in normal, intact individuals. (Required courses in this option: 62.864, 62.884)

Sample Program

Basic M.S. Requirements

Specialization Courses (12 q.h.)

- | | |
|--------|--|
| 62.822 | Problems in Contemporary Athletics for Men and Women |
| 62.842 | Physical Education for Students with Special Needs |
| 62.845 | Management of Adapted Movement Performance Programs |
| 62.860 | Early Childhood Motor Patterns |
| 62.864 | Perceptual Motor Development |
| 62.870 | Philosophies in Physical Education and Sport |
| 62.880 | Sociology of Sport |
| 62.884 | Movement and the Learning Process |

Electives (20 q.h.)

Special prerequisites apply to this program. See page 31.

Programs in Physical Therapy

The programs in Physical Therapy address the need for clinical specialization within the field of physical therapy. Three areas of clinical specialty in physical therapy practice are covered in the range of program options designed to meet criteria recommended by the American

Physical Therapy Association. At present, the Department of Physical Therapy offers only the clinical specialty in Cardiopulmonary Physical Therapy. This option, however, is being augmented by the introduction of a Neurological Physical Therapy specialty in the fall of 1982 and an Orthopedic Physical Therapy specialty in the fall of 1984.

Students specializing in Cardiopulmonary Physical Therapy have the opportunity to develop a clinical expertise in the evaluation, treatment, and prevention of medical and surgical cardiopulmonary conditions.

Sample Program

Basic M.S. Requirements

Specialization Requirements

- | | |
|--------|--|
| 62.855 | Exercise in Cardiovascular Health and Disease |
| 64.813 | Cardiopulmonary Pathophysiology |
| 64.815 | Cardiopulmonary Diagnostic Techniques |
| 64.820 | Cardiac Rehabilitation Programs Phase I and II |
| 64.822 | Pulmonary Rehabilitation Programs |
| 64.825 | Conditions of Cardiac and Pulmonary Patients |
| 64.826 | Medical Conditions of Cardiac and Pulmonary Patients |
| 62.865 | Electrocardiography |
| 62.866 | Laboratory in Exercise Testing and Prescription |
| 64.810 | Practicum in Physical Therapy (if required) |
| | or |
| | Elective |

To help prepare for more diversified positions in the health-care setting, students should satisfy remaining credit requirements by selecting additional course work in one of the areas of research, education, administration, or clinical specialization.

Programs in Recreation and Leisure Studies

The Department of Recreation and Leisure Studies offers students the opportunity to select a master's degree program in one of two areas of professional specialization: Recreation Management or Therapeutic Recreation. In addition to completing the basic M.S. requirements, students enrolled in one of these programs are expected to complete twenty-four quarter hours of departmental course work,

including twelve quarter hours of departmental core classes and twelve quarter hours selected from the major area in which they are concentrating. Eight additional quarter hours of elective courses may be selected from other graduate offerings in the College or University.

Concentration in Recreation Management

The Recreation Management concentration is designed to assist students in acquiring advanced knowledge and developing skills that will enable them to assume a variety of leisure-service management positions. Upon graduation, students may pursue positions in commercial recreation and tourism, planning firms, health and fitness centers, federal agencies, and private agencies.

Concentration in Therapeutic Recreation

The Therapeutic Recreation concentration is designed to offer students opportunities to acquire advanced professional job skills that are essential for work with disabled people in positions in community-based settings and institutional settings, including hospitals, rehabilitation facilities, schools, and residential centers, as well as day-care, extended-care, shelter, and other transitional-care facilities.

Sample Program

Basic M.S. Requirements

Departmental Core Course Requirements

- 63.802 Contemporary Theories of Recreation and Leisure
- 63.812 Seminar in Contemporary Issues and Problems in Recreation Services
- 63.805 Program Evaluation in Recreation and Leisure Services

Specializations

Recreation Management Courses

- 63.814 Grantsmanship
- 63.816 Budgeting Systems
- 63.830 Advanced Organization and Administration of Recreation and Leisure Services
- 63.836 Public Relations for Recreation and Leisure Agencies

Therapeutic Recreation Courses

- 63.850 Therapeutic Recreation Services for Special Populations

- | | |
|--------|---|
| 63.852 | Seminar on Programming in Therapeutic Recreation |
| 63.853 | Therapeutic Recreation: Interaction and Intervention Techniques |
| 63.854 | Observations of Therapeutic Recreation in Treatment Settings |

Electives

Programs in Rehabilitation and Special Education

The Department of Rehabilitation and Special Education offers several graduate-level programs designed to offer practical training and competency preparation to individuals working with special-needs populations.

Integral to the various program curricula is a practicum or field experience, offering students the opportunity to acquire significant exposure to the practical application of theory and skills in a professional situation. While the actual nature of practicum requirements and the duration of such experiences vary from one program to another, students are assured of the opportunity to pursue their individual interests through practicum placements designed to integrate their work experiences with didactic portions of the program.

Program in Rehabilitation Administration

The master's degree program in Rehabilitation Administration is designed to help prepare students to meet both current and future personnel needs of expanding rehabilitation, health-care, and human-service programs in the United States and abroad. Academic course work is integrated with approximately 500 hours of practical experience in health and human-service programs, and courses of study are varied to enable each student to develop individual programmatic interests.

Sample Program

Basic M.Ed. Requirements

Departmental Course Requirements

- | | |
|--------|--|
| 56.950 | Introduction to Rehabilitation |
| 56.951 | Principles of Medical Rehabilitation |
| 56.952 | Program Development in Rehabilitation |
| 56.953 | Organization and Administrative Theory |
| 56.961 | Fiscal Policy and Management I |

- 56.963 Fiscal Policy and Management II
- 56.832 Group Dynamics
- 56.960 Practicum in Rehabilitation
- 56.956 Community Planning in Rehabilitation

Electives (chosen from prescribed course listing in consultation with adviser)

Programs in Rehabilitation Counseling

Both M.Ed. and CAGS programs are available in the area of Rehabilitation Counseling. The curricula for these programs are structured to help meet the needs of students interested in providing comprehensive services to the disabled and handicapped, offering the opportunity for specializations in Deafness, Mental Retardation, Mental Illness, Addiction/Alcoholism, Severe Special Needs, and Corrections. In addition to the required academic course work, students enrolled in the programs participate in a 600-hour practicum experience supplemented by seminar meetings that assist them in integrating theory with practice.

Sample M.Ed. Program

Basic M.Ed. Requirements

Departmental Course Requirements

- 56.950 Introduction to Rehabilitation
- 56.951 Principles of Medical Rehabilitation
- 56.965 Occupational Placement
- 56.980 Psychological Problems of Disability
- 56.960 Practicum in Rehabilitation Counseling

Specialized Courses

- 53.801 Tests and Test Procedures
- 53.804 Counseling Theory and Practice
- 53.815 Rehabilitation Counseling Strategies

Electives (chosen from recommended course listing in consultation with adviser)

Specialization in Deafness

A specialized component in deafness rehabilitation is available as part of the Rehabilitation Counseling program. Students who wish to specialize in this area may be required to take the following courses in addition to those requirements listed above:

- 55.823 Psychosocial Aspects of Communication Disorders
- 55.829 Foundations of Deaf Education

55.867	Intermediate Sign Language
55.868	Advanced Sign Language
19.890	American Sign Language I
19.891	American Sign Language II
19.892	ASL Intermediate I

Teacher Training Program: Moderate Special Needs

The Department of Rehabilitation and Special Education offers a master's-level teacher training program in Moderate Special Needs. A competency-based program approved by the Massachusetts State Department of Education, the program curriculum is designed to enable students who successfully complete program requirements to receive certification to teach children and adults having any of a wide range of moderate handicapping conditions—for example, mild mental retardation, learning disabilities, emotional disturbances, communication disorders, and certain physical impairments. Applicants to this program must hold or be eligible for regular teacher certification.

Sample Program

Basic M.Ed. Requirements

Departmental Course Requirements

55.806	Language Disturbances in Children
56.807	Educating Individuals with Learning Disabilities
56.831	Educating Individuals with Behavioral Disorders
56.840	Psychology of Individuals with Special Needs
56.846-7	Special Needs: Diagnostic-Prescriptive Teaching I and II
56.880-1	Etiology and Development of Special Needs
56.850	Fieldwork and Seminar
56.851	Student Teaching and Seminar

Teacher Training Program: Severe Special Needs

According to Massachusetts standard requirements for certification, teachers of severely handicapped children are expected to have competencies enabling them to work with and evaluate their students in several areas, including activities of daily living, sensory/motor performance, socialization, and language performance. The Severely Handicapped Teacher Training program offers a master's-level curriculum structured to help

students acquire these competencies through both course work and practicum experience. The program provides students the opportunity to acquire the necessary preparation to function as trained and skilled professional personnel who work closely with severely handicapped children. Students who successfully complete program requirements are eligible to receive Massachusetts certification in Severe Special Needs.

Sample Program

Basic M.Ed. Requirements

Departmental Course Requirements

- | | |
|----------|---|
| 56.880-1 | Etiology and Development of Special Needs |
| 55.806 | Language Disturbances in Children |
| 56.846-7 | Special Needs: Diagnostic-Prescriptive Teaching I and II |
| 56.839 | The Severely Handicapped |
| 56.838 | Development and Implementation of Programs for the Severely Handicapped |
| 56.835 | Socio- and Psychodynamics of Family Life |

Electives (chosen in consultation with adviser)

Programs in Speech-Language Pathology and Audiology

The programs leading to the degrees of Master of Education in Speech-Language Pathology and in Audiology are designed to help students prepare for certification by and membership in the American Speech-Language-Hearing Association (ASHA). It is assumed that students entering these programs have completed undergraduate degree programs in speech and hearing and are prepared to devote full-time study to their program. Part-time student status is discouraged and is available only to candidates who are currently employed in the field but who are not holders of the Certificate of Clinical Competence issued by ASHA. Full-time students are not allowed to change their status to part time once accepted for full-time study.

The degree programs in Speech-Language Pathology and in Audiology are fully accredited by ASHA-ETB (Educational Training Board) and are designed to distribute the student's course work to cover all major professional areas.

Sample Program in Speech-Language Pathology

Basic M.Ed. Requirements

Departmental Requirements

- | | |
|------------|---|
| 55.816 | Test Procedures in Speech and Language Pathology |
| 55.812 | Differential Diagnosis in Speech and Language Pathology |
| 55.804 | Neurological Bases of Communication |
| 55.805 | Seminar: Voice Disorders |
| 55.806 | Language Disturbances in Children |
| 55.811 | Clinical Management of Stuttering |
| 55.860 | Aphasia Rehabilitation |
| 55.865 | Seminar: Speech Science |
| 55.875,6,7 | Advanced Clinical Practice I, II, III |

Departmental Electives (minimum of one)

Sample Program in Audiology

Basic M.Ed. Requirements

Departmental Requirements

- | | |
|------------|---------------------------------------|
| 55.804 | Neurological Bases of Communication |
| 55.814 | Clinical Audiometry I |
| 55.815 | Clinical Audiology |
| 55.818 | Pathologies of the Ear |
| 55.819 | Clinical Audiometry II |
| 55.821 | Seminar: Audiology |
| 55.828 | Aural Rehabilitation |
| 55.862 | Psychoacoustics |
| 55.866 | Hearing Science Seminar |
| 55.875,6,7 | Advanced Clinical Practice I, II, III |

Departmental Electives (minimum of one)

Prerequisites for Physical Education Concentrations in Exercise Sciences and Movement Behavior

Students applying for concentration in Exercise Sciences or Movement Behavior must possess an undergraduate degree in physical education or present a minimum of eighteen semester hours (twenty-four quarter hours) of work in the following specified prerequisite courses:

Anatomy and Physiology	8 q.h.
Kinesiology	4 q.h.
Motor Learning and Development	4 q.h.
Exercise Physiology	4 q.h.
Measurement and Evaluation	4 q.h.

Doctor of Education Programs

General Information

Admission

Applicants for admission to the Doctor of Education degree program must file evidence of a master's degree and such other materials as are requested by the Graduate School for due consideration of the individual candidate's request for admission. Applicants are expected to have completed three years of successful professional administrative or leadership experience as attested to by their supervisors. Other experiences are evaluated by the appropriate department in individual cases.

Students already enrolled in a master's degree program in Boston-Bouvé Graduate School who expect to receive that degree within two terms of the time of application may submit materials for application consideration. Students who have graduated from or are enrolled as regular CAGS students in the Graduate School may also apply for the doctoral degree program. Although most CAGS course work is applicable, different admissions criteria apply, necessitating formal application. Conversely, regular doctoral students who choose not to complete the degree program or are disqualified from continuing may make formal application for transfer to the CAGS program.

Applicants to a doctoral program of study must declare a major field of specialization, submit a written statement of purpose in pursuing doctoral study, and, if requested, meet with an admissions committee for further evaluation. Specific admission requirements for the doctoral program are identical to those listed for the master's-level programs on page 8, with the exception that applicants for all doctoral programs must submit GRE scores.

Applications to the Doctor of Education degree programs are acted upon twice a year. Application materials must be completed by April 1 for individuals wishing to be considered for admission in the summer or fall quarters and by November 1 for those wishing to be considered for admission in the winter or spring quarters. Notification of admission status may be expected by May 15 and December 15, respectively.

Classification and Degree Candidacy

Students taking advanced graduate work are classified as follows:

1. Doctoral Student Students in this classification have been accepted for doctoral study, but have not yet passed the qualifying examination.

2. Doctoral Degree Candidate Students in this classification have completed forty-eight quarter hours of graduate work, including intermediate statistics, and have passed the qualifying examination.

Academic Requirements

To qualify for the Doctor of Education degree, students must maintain a B (3.000) average in their course work. No additional course credits are allowed to satisfy the B (3.000) average required for the degree. No student who receives a grade lower than B (3.000) in three or more courses is permitted to continue in the program. In addition, students who accumulate two grades of C from the same faculty member may not register for a third course with this faculty member. Students who receive a grade of F or U in a course must make up this course in accordance with their adviser's recommendation. Students who receive a grade of F or U in more than one course are not permitted to continue in the program.

Residency

In addition to course requirements, each student is expected to complete three quarters of full-time study in residence. Two of these quarters must be consecutive (one of which may be in the summer quarter); the third may occur at any time in the program or may be fulfilled through a full-time internship.

Qualifying Examination

Each doctoral student seeking degree candidacy must take a qualifying examination for the purpose of evaluating the student's general understanding of the field of specialization. The qualifying examination should be taken at a time when the student has completed forty to forty-eight quarter hours of doctoral study.

Comprehensive Examination

After completion of all formal course work, the doctoral degree candidate must satisfactorily demonstrate, by means of a comprehensive examination, breadth and depth of knowledge in the

area of specialization as well as general professional understanding and comprehension of major issues in related fields.

Dissertation

As part of the doctoral program, each candidate must complete a dissertation that embodies extended and creative independent research as well as proper evaluation and interpretation of its results. A Dissertation Committee, made up of a major adviser and at least two other faculty members, must approve the dissertation.

Final Oral Examination

Students take the final oral examination after completion of all other requirements for the doctoral degree. The substance of this examination includes the subject matter of the student's doctoral dissertation and significant developments in the area of his or her specialization.

The oral examination is scheduled at least eight weeks before the commencement at which the degree would be awarded, and results of the examination are immediately made available to the student.

Transfer Credit

The doctoral student's adviser may recommend that the Graduate Committee of Boston-Bouv  Graduate School award transfer credit for up to 25 percent of the course work required of the student to complete the doctoral degree. Credit offered for transfer must consist of work taken at the graduate level for credit beyond a master's degree, have been earned at an accredited institution, and carry grades of A or B.

Students desiring transfer credit should petition the Graduate School, in writing, by completing the necessary form obtainable from the Graduate School office or their faculty adviser. The completed form must be submitted to the Director of the Graduate School together with an official transcript and an excerpt from the catalog describing the course(s) for which transfer credit is requested. No transfer-credit request form will be considered complete without the signature of the student's adviser or department chairperson. Grades on transfer credits may not be used for the purpose of obtaining the academic average necessary for the completion of degree requirements.

Students are informed in writing when transfer credit is officially awarded.

Time Limitation

Students must complete degree requirements within a maximum of five years after admission to degree candidacy. Any extension of this time must be approved by the Committee of the Boston-Bouvé Graduate School.

Course credits earned in the program of graduate study or accepted by transfer are valid for a maximum of seven years from the time taken to completion of degree requirements.

Course Descriptions

Course descriptions are available in the academic departments and in the Graduate School office.

Program Descriptions

The Graduate School of Boston-Bouvé College of Human Development Professions offers several Doctor of Education programs in the area of Leadership: Administration and Supervision. Specific concentrations are available in Pupil and Student Personnel Administration, Cooperative Education Administration, Higher Education and School Administration, and Special Education and Rehabilitation Administration.

Doctoral programs in the Graduate School are offered jointly by the various departments and bring together relevant aspects of each.

Although each student's program is individually developed, some general requirements apply to all. In addition to those requirements outlined on pages 33-35, doctoral students must complete the required core courses listed under the sample program. In each student's program, the major field of study must be complemented by two minor areas of study.

Sample Program

Required Core Courses

- 52.850 Doctoral Seminar in Leadership: Administration and Supervision I
- 52.851 Doctoral Seminar in Leadership: Administration and Supervision II
- 52.852 Doctoral Seminar in Leadership: Administration and Supervision III

Specialization Courses

A planned sequence of courses (minimum of thirty-two quarter hours) in the student's specific area of concentration

Supporting Minor Area Courses

A planned sequence of graduate courses (minimum of twelve quarter hours) from offerings available in programs outside Boston-Bouvé College of Human Development Professions; in addition to a planned sequence of graduate courses (minimum of twelve quarter hours) from offerings available within Boston-Bouvé Graduate School.

Dissertation and Appropriate Seminar

Financial Information

Tuition

Tuition for master's degree candidates, CAGS candidates, doctoral candidates, and special students is \$85 per quarter hour of credit. Tuition for audited courses is the same as for courses taken for credit. There is a special tuition charge of \$815 for the following: 51.805 Student Teaching, 51.873 and 51.875 Reading Clinic I and II, 51.893-894 Seminar in Supervision of Instruction and Practicum, 53.805-806 Counseling Practicum, 53.840-841 Advanced Fieldwork, 53.843-844 School Psychology Fieldwork, 55.875-877 Advanced Clinical Practice, 55.852 Student Teaching of the Hearing Impaired, 56.850-851 Fieldwork and Student Teaching, 56.853-854 Fieldwork and Practicum, 56.960 Practicum in Rehabilitation, 93.802-803 Practicum in Early Childhood Education I and II, and Thesis.

A special tuition fee of \$407.50 is charged for 52.843 Administrative Internship and 56.970 CAGS Rehabilitation Practicum as well as for Counselor Education interns enrolled in the Boston School System.

The tuition charge for the doctoral dissertation is \$600, to be paid when registering for the dissertation. At the completion of formal course work for the doctorate, a dissertation continuation fee of \$50 per quarter is charged until completion of the dissertation.

A \$100 nonrefundable tuition deposit, payable upon acceptance into the programs, is required of all full-time students accepted by the Departments of Counselor Education and Speech-Language Pathology and Audiology. This deposit is applied to the tuition for the first quarter of study.

Tuition statements are mailed to students by the Bursar's Office and are payable by check to Northeastern University on or before the date specified. Tuition rates and fees are subject to revision by the Board of Trustees at any time.

Fees and Refunds

An application fee of \$25 (nonrefundable) is charged to all students applying for admission to Boston-Bouvé Graduate School. No application papers are processed until this fee is

received. Checks should be made payable to Northeastern University and submitted with application materials to Boston-Bouvé Graduate School, 102 Fenway, Boston, Massachusetts 02115.

Other fees include a charge of \$25 to \$50 for late payment of tuition, a fee of \$5 for deferred tuition (with approval of the Bursar), and a graduation fee of \$25 for all degree candidates, payable by the applicable date listed on the academic calendar, usually four weeks before commencement.

In addition, there is a one-time fee of \$100 charged to new graduate international students, payable upon acceptance at Northeastern.

Full-time students are charged \$12.50 per quarter for the services available in the Student Center. The same fee for teaching assistants and research fellows is \$6.25 each quarter. Part-time students on the Huntington Avenue campus are charged \$.75 per quarter.

All full-time students, including those with assistantships and fellowships, also pay a nonrefundable University Health Services fee of \$200 per year for Blue Cross-Blue Shield coverage. Payment of this fee entitles the student to medical care provided by the University Health Service.

All financial obligations to the University must be cleared before graduation.

Assistantships

The Graduate School awards a limited number of assistantships to qualified students each year. Some awards offer remission of tuition; other awards carry a tuition scholarship and also offer students the opportunity to earn a small stipend. The assigned duties and hours of work students assume with the award vary, depending on the specific award.

Students interested in applying for assistantships should contact Boston-Bouvé Graduate School, 102 The Fenway, Boston, Massachusetts 02115. Students applying must also file a (GAPSFAS) and a Graduate School Information and Application form with the Office of Financial Aid.

Financial Aid

The Office of Financial Aid offers several types of limited assistance to eligible graduate students. All awards are based on financial need. Since the majority of these awards are sponsored by the federal government, the amount of aid granted is

determined by the amount of funds allocated to Northeastern University each year.

In order to meet the financial aid application deadlines, students may have to apply for financial aid before they have been offered admission to the Graduate School. However, only those students who have been accepted are reviewed for financial aid.

Although students who are not United States citizens are eligible for fellowships, assistantships, and tuition scholarships, the University awards financial aid only to eligible students who are U.S. citizens and permanent residents of the United States. Students who are studying in the United States on student visas are not eligible for federal assistance.

Students interested in information concerning the National Direct Student Loan, the College Work-Study Program, and the Guaranteed Student Loan Program should write the Financial Aid Office, 254 Richards Hall, Northeastern University, 360 Huntington Avenue, Boston, Massachusetts 02115.

General Regulations

Policy Statement

The general regulations and minimum requirements for all graduate programs are established by the Northeastern Graduate Council. In some matters, the committee of each graduate school is allowed discretion to establish regulations within limits defined by the Council. The regulations and academic requirements that follow have been formulated in accordance with this general policy. Students who wish to have consideration for variations in existing policy may petition the Committee of Boston-Bouv  Graduate School.

Residence

All work for advanced degrees must be completed at the University unless approval for work taken elsewhere has been obtained from the Director of the Graduate School. Students who are in residence and are using the facilities of the University must register for such work.

Grading System

Students' performance in graduate courses is graded according to the following numerical equivalents:

- A** (4.000) This grade is given to those students whose performance in the course is of very high graduate caliber.
- A-** (3.667)
- B+** (3.333)
- B** (3.000) This grade is given to those students whose performance in the course is at a satisfactory level.
- B-** (2.667)
- C+** (2.333)
- C** (2.000) This grade is given to those students whose performance in the course is not at the level expected in graduate work.
- C-** (1.667)
- F** (0) This grade is given to those students whose performance in the course is unacceptable.

In addition, the following letter designations are used:

- I** Incomplete
This grade is given to those students who fail to complete the work of the course.
- L** Audit without credit
- S** Satisfactory without quality designation
- U** Unsatisfactory without quality designation

Grades S and U may be used for the first quarter of a two-quarter sequence in which the grade for the second quarter applies to both the first and second quarters of the sequence.

The I grade is changed to a letter grade upon removal of the deficiency that caused the grade of I to be reported. Deficiencies must be made up within the quarter following that for which the grade of I is received unless an extension of time is granted by the instructor. Any I grade outstanding for twelve months or more remains permanently and irreversibly as an I grade on the student's record.

The University does not process grades for students who are not officially registered by the end of the fifth calendar week of a quarter.

Changes in Requirements

The continuing development of the Graduate School may occasion frequent revision of curricula. In every new bulletin some improvements are announced. When no hardship is imposed on the student because of such changes, and when the facilities of the school permit, the student is expected to meet the requirements of the latest bulletin. If the student finds it impossible to meet these requirements, the bulletin for the year in which he or she entered becomes the binding one.

Application for Degree

Students must officially apply for a degree by completing a commencement card. If the commencement card is not filed with the Registrar's Office on or before the applicable date listed on the calendar, there is no assurance that the degree will be granted in that particular year even though all other requirements have been fulfilled.

Academic Classification

- 1. Regular** Applicants who meet in full the criteria for immediate matriculation are classified as regular students.

- 2. Provisional** Some applicants who do not meet regular admissions standards may be admitted as provisional students. Such students must maintain a B (3.000) average in their first twelve quarter hours of work in order to continue in the graduate program. Provisional students admitted for part-time study may take only one course in their first quarter of study.
- 3. Special** Applicants who have earned a bachelor's degree from an accredited institution and who acknowledge that they do not wish to pursue a degree may be accepted as special students.

Auditing

A student may audit a course without credit by obtaining, prior to registration, the written approval of the instructor of the course and by presenting this permit at the office of the Boston-Bouvé Graduate School. No change either to or from the audit status may be made after the first day of classes. Tuition for an audit course is the same as for a course taken for credit.

Class Hours and Credits

All credits are entered as quarter hours. A quarter hour of credit is equivalent to three-fourths of a semester-hour credit. The academic calendar at the back of this bulletin should be consulted to determine the opening and closing dates of each quarter. It should be noted that most classes meet either in the late afternoon or evening.

Continuity of Program

Students are expected to maintain continuous progress toward a degree. Any student who has been admitted to a degree program and completed at least one course, but not attended for a period of one year, must submit to the office of Boston-Bouvé Graduate School a written request for reinstatement in the program. After receiving formal notification of reinstatement, students must meet with their program advisers to make any necessary program adjustments.

Withdrawals

To withdraw from a course, students must fill out an official withdrawal form obtained at the Registrar's office or at the Burlington Campus office. Withdrawals may be made through

the ninth week of the quarter. Students are withdrawn as of the date on which the form is returned to the Office of the Registrar, Room 120 Hayden Hall. Ceasing to attend a class or simply notifying the instructor of intention to withdraw does not constitute an official withdrawal.

Academic withdrawals from Boston-Bouvé Graduate School are made by the Director when students fail to meet the academic requirements.

A grade of W is given to students who withdraw after the fifth calendar week of a quarter.

The University

Founded in 1889, Northeastern University is incorporated as a privately endowed nonsectarian institution of higher learning under the General Laws of Massachusetts. The state legislature by special enactment has given the University general degree-granting powers. The University is governed by a Board of Trustees elected by and from the Northeastern University Corporation, which is composed of nearly 180 distinguished business and professional men and women.

From its beginning, Northeastern University has held the primary goals of discovering community educational needs and meeting these needs in distinctive and serviceable ways. The University has not attempted to duplicate the programs of other institutions, but has sought to pioneer new areas of educational service.

A distinctive feature of Northeastern University is its Cooperative Plan of Education initiated by the College of Engineering in 1909 and subsequently adopted by the other colleges of the University. This educational method offers students the opportunity to gain valuable practical experience as an integral part of their college program and often provides the means by which they may contribute substantially to the financing of their education. The Plan has been extended to the graduate level in engineering, professional accounting, business administration, and law.

In the field of adult education, programs of study have been developed to meet a variety of needs. University College offers evening courses—available at the University since 1906—and adult day courses leading to the bachelor's degree. In addition to offering day undergraduate programs in Electrical Engineering Technology and Mechanical Engineering Technology, Lincoln College offers evening/part-time certificate, associate, and bachelor degree programs in technological areas.

Graduate and Professional Schools

The eight graduate and professional schools of the University offer numerous programs of study leading to the following degrees:

The Graduate School of Arts and Sciences offers the degrees of Master of Arts, Master of Science, Master of Science in Health Science, Master of Public Administration, and Doctor of Philosophy, as well as a Certificate of Advanced Graduate Study in Advanced Literary Study.

The Graduate School of Boston-Bouvé College of Human Development Professions offers the degrees of Master of Education, Master of Science, and Doctor of Education in addition to the Certificate of Advanced Graduate Study.

The Graduate School of Business Administration offers the degree of Master of Business Administration.

The Graduate School of Criminal Justice offers the degree of Master of Science.

The Graduate School of Engineering offers the degrees of Master of Science, Engineer degree, Doctor of Engineering, and Doctor of Philosophy.

The School of Law offers the degree of Juris Doctor.

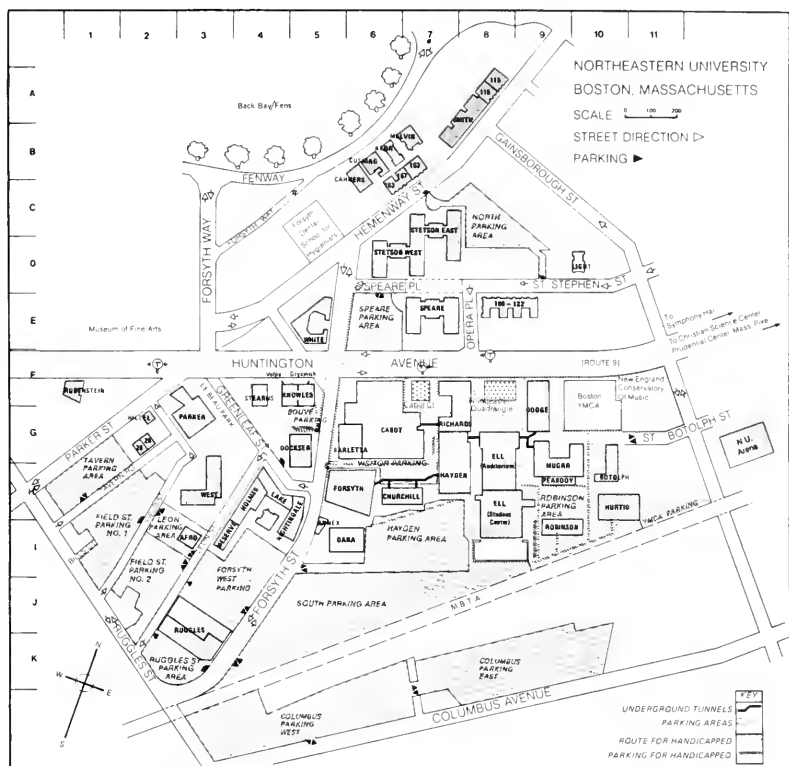
The Graduate School of Pharmacy and Allied Health Professions offers the degrees of Master of Science, Doctor of Philosophy, and Doctor of Pharmacy.

The Graduate School of Professional Accounting offers the degree of Master of Science in Accounting.

Department Directory

	Room	Phone
Associate Dean and Director of Graduate School	119 CU	437-3297
Assistant Dean of Graduate School	118 CU	437-2708
Coordinator of Graduate Admissions	118 CU	437-2708
Department of Counselor Education	405 CU	437-3276
Department of Curriculum and Instruction	1 LA	437-3302
Department of Educational Administration	225 CU	437-3286
Department of Foundations of Education	306 CU	437-3282
Department of Health Education	304 DK	437-3145
Department of Physical Education	105 DK	437-3153
Department of Physical Therapy	308 RB	437-3160
Department of Recreation and Leisure Studies	3 DK	437-3163
Department of Rehabilitation and Special Education	202 LA	437-2485
Department of Speech-Language Pathology and Audiology	106 FR	437-2493

Campus Map



Academic Calendar

Fall Quarter 1981

Registration period		
Burlington	Sept. 15-16	1:00-3:00 p.m., 5:30-8:00 p.m.
Boston	Sept. 21-24	1:00-8:00 p.m.
Classes begin	Sept. 28	
Examination period	Dec. 14-19	

Winter Quarter 1981-82

Registration period		
Burlington	Dec. 1	1:00-3:00 p.m., 5:30-8:00 p.m.
Boston	Dec. 7-10	1:00-3:00 p.m., 5:30-8:00 p.m.
Classes begin	Jan. 4	
Examination period	March 22-27	

Spring Quarter 1982

Registration period		
Burlington	March 9	1:00-3:00 p.m., 5:30-8:00 p.m.
Boston	March 15-18	1:00-3:00 p.m., 5:30-8:00 p.m.
Classes begin	April 5	
Examination period	June 14-19	

Summer Quarter 1982

Registration period		
Burlington	June 14-15	5:30-8:00 p.m.
Boston	June 16-17	5:30-8:00 p.m.
Classes begin	June 28	
Examination period	Aug. 4-5	

University Holidays 1981-82

Columbus Day	Monday	October 12
Veterans Day	Wednesday	November 11
Thanksgiving Recess	Thursday-Saturday	November 26-28
Christmas Vacation	Monday-Saturday	Dec. 21-Jan. 2
Martin Luther King Day	Friday	January 15
Washington's Birthday	Monday	February 15
Patriot's Day	Monday	April 19
Memorial Day	Monday	May 24
Independence Day	Monday	July 5
Labor Day	Monday	September 6

Calendar changes may be made. The University community will be notified if such changes are necessary.

Emergency Closing of the University

Northeastern University has made arrangements to notify students, faculty, and staff by radio when it becomes necessary to cancel classes because of extremely inclement weather. Radio stations WBZ, WEEL, WHDH, WJDA, WRKO, WKOX, WHAV, WCOZ-FM, WNSR, WLYN-FM, WVBF-FM, WHUE, and WLLH will announce the University's decision to close.

Equal Opportunity Policy

Northeastern University is committed to a policy of providing equal opportunity for all. In all matters involving admissions, registration, and all official relationships with students, including evaluation of academic performance, the University insists on a policy of nondiscrimination. Northeastern University is also an equal opportunity employer; it is institutional policy that there shall not be any discrimination against any employee or applicant for employment because of race, color, religion, sex, age, national origin, or on the basis of being a handicapped but otherwise qualified individual. In addition, Northeastern takes affirmative action in the recruitment of students and employees. Inquiries concerning our equal opportunity policies may be referred to the University Affirmative Action Officer, 175 Richards Hall, 617-437-2133 or 2139. Northeastern's efforts to comply with the Title IX Educational Amendments of 1972 are also coordinated by the Dean and Director of Affirmative Action, 175 Richards Hall, 617-437-2133.

Family Educational Rights and Privacy Act

In accordance with the Family Educational Rights and Privacy Act of 1974, Northeastern University permits its students to inspect their records wherever appropriate and to challenge specific parts of them when they feel it necessary to do so. Specific details of the law as it applies to Northeastern are printed in the *Student Handbook* and are distributed annually at registrations of University College and the graduate schools.

Delivery of Services

The University assumes no liability, and hereby expressly negates the same, for failure to provide or delay in providing educational or related services or facilities or for any other failure or delay in performance arising out of or due to causes beyond the reasonable control of the University, which causes include, without limitation, power failure, fire, strikes by University employees or others, damage by the elements and acts of public authorities. The University will, however, exert reasonable efforts, when in its judgment it is appropriate to do so, to provide comparable or substantially equivalent services, facilities or performance, but its inability or failure to do so shall not subject it to liability.

The Northeastern University catalog contains *current information* regarding the University calendar, admissions, degree

requirements, fees and regulations, and such information is not intended to be and should not be relied upon as a statement of the University's contractual undertakings.

Northeastern University reserves the right in its sole judgment to promulgate and change rules and regulations and to make changes of any nature in its program, calendar, admissions policies, procedures and standards, degree requirements, fees, and academic schedule whenever it is deemed necessary or desirable, including, without limitation, changes in course content, the rescheduling of classes, cancelling of scheduled classes and other academic activities and requiring or affording alternatives for scheduled classes or other academic activities, in any such case giving such notice as is reasonably practicable under the circumstances.

We at Northeastern will do our best to make available to you the finest education we can provide, the most stimulating atmosphere in which to learn, and the most congenial conditions under which you may enjoy the learning experience. But the quality and the rate of progress of your academic career is in large measure dependent upon your own abilities, commitment, and effort. You will be a full participant in an educational partnership. We will and, indeed, can only make the opportunities available to you; it is up to you to take advantage of them.

This is equally true with your career upon graduation. We cannot guarantee that you will obtain any particular job; that will depend upon your own skills, achievement, presentation, and other factors such as market conditions at that time. Similarly, in many professions and occupations there are increasing requirements imposed by federal and state statutes and regulatory agencies for certification or entry into a particular field. These may change during the period of time when you are at Northeastern and they may vary from state to state. While we will be ready to help you find out about these requirements and changes, it is your responsibility to initiate the inquiry because we cannot know what your expectations and understanding are unless you tell us.

In brief, what we are saying to you is that we are here to offer you educational opportunities and choices and to assist you in finding the direction in which you want to steer your educational experience. But you are a partner in this venture with an obligation and responsibility to yourself.

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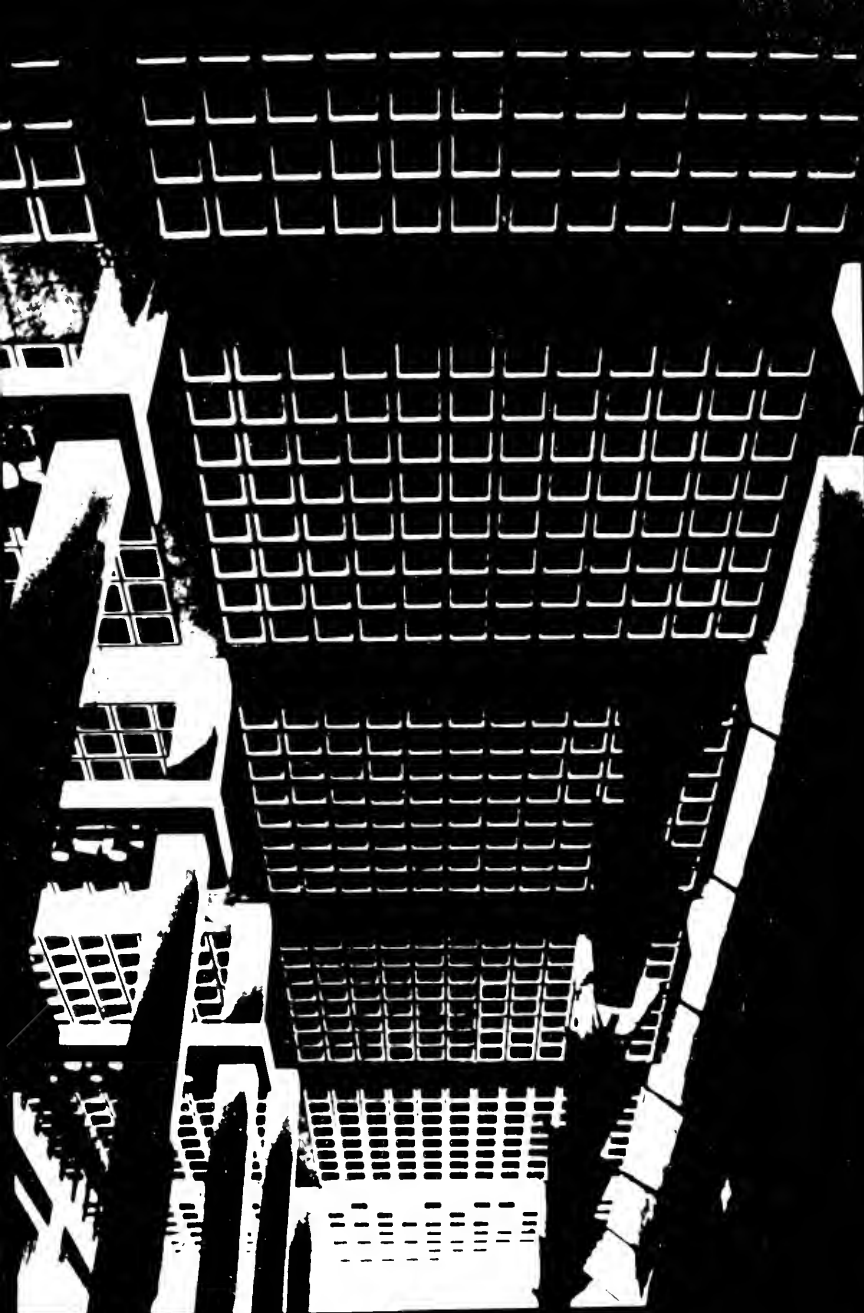
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1981-82
Lincoln College
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Lincoln College

Day and evening programs in:
aviation technology
engineering technology
science technology

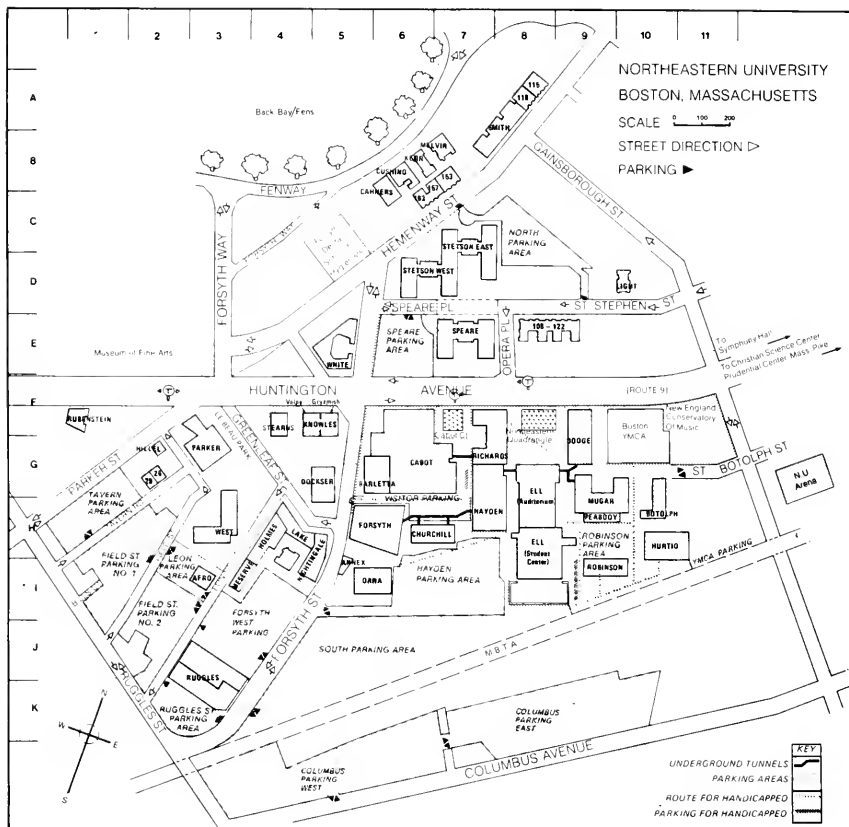
Northeastern University
360 Huntington Avenue
Boston, Massachusetts 02115



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Office Hours at Huntington Avenue Campus, Boston

June 19, 1981—June 18, 1982

Monday-Thursday 8:30 a.m.-8:00 p.m.
Friday 8:30 a.m.-4:30 p.m.

Program Counseling at Suburban Campus, Burlington

Representatives from the Huntington Avenue campus will be in attendance during specified dates for guidance and counseling. The bookstore is open from 8:00 a.m.-7:00 p.m. Monday through Thursday; 8:00 a.m.-4:00 p.m. on Friday; the Bursar's Office is open from 8:30 a.m.-8:00 p.m. Monday through Thursday; 8:30 a.m.-4:30 p.m. on Friday.

Program Counseling at Extensions

Program counselors are available on a regular schedule at Lincoln College extensions at Framingham North High School, Norwood North Junior High School, and Weymouth High School. Appointments may be arranged by telephoning the Lincoln College office at 437-2500.

Interviews

Prospective students, or those desiring advice or guidance regarding any part of the school work or curricula, are encouraged to arrange for personal interviews. Career planning through competent guidance provides an understanding of professional requirements and develops that definiteness of purpose so vital to success. The Lincoln College office is located at 408 Churchill Hall on the Boston Campus.

Address communications to:

William F. King, Director
Lincoln College
Northeastern University
360 Huntington Avenue
Boston, Massachusetts 02115
Telephone 437-2500

Aeronautical Technology
Suburban Campus
South Bedford Road
Burlington, Massachusetts 01803
Telephone 272-5500
Extension 35

1981–1982 ACADEMIC CALENDAR (times and dates subject to change)

Fall Quarter 1981 Classes Begin Monday, September 28, 1981

FALL REGISTRATION DATES

Boston	5:00–8:00 p.m.	Tuesday-Friday September 8–11
	9:00 a.m.–12 Noon	Saturday, September 12
	5:00–8:00 p.m.	Monday-Thursday September 14–17
Burlington	5:00–8:00 p.m.	Monday-Thursday September 14–17
	1:00–8:00 p.m.	Tuesday, September 15
Belmont H.S.	5:30–8:00 p.m.	Thursday, September 10 and Tuesday, September 15
Brockton H.S.	5:30–8:00 p.m.	Wednesday, September 9 and Monday, September 14
Framingham North H.S.	5:30–8:00 p.m.	Tuesday, September 8 and Monday, September 14
Marshfield H.S.	5:30–8:00 p.m.	Thursday, September 10 and Tuesday, September 15
Milford H.S.	5:30–8:00 p.m.	Tuesday, September 8 and Tuesday, September 15
Norwood Jr. H.S. North	5:30–8:00 p.m.	Wednesday, September 9 and Monday, September 14
Reading (Austin Prep.)	5:30–8:00 p.m.	Tuesday, September 8 and Tuesday, September 15
Revere (Abraham Lincoln School)	5:30–8:00 p.m.	Thursday, September 10 and Tuesday, September 15
Sandwich H.S.	5:30–8:00 p.m.	Wednesday, September 9 and Monday, September 14
Westwood H.S.	5:30–8:00 p.m.	Thursday, September 10 and Tuesday, September 15
Weymouth North H.S.	5:30–8:00 p.m.	Wednesday, September 9 and Monday, September 14
Fall Quarter Classes Begin		Monday, September 28
Columbus Day Observed	No Classes	Monday, October 12
Veterans' Day Observed	No Classes	Wednesday, November 11
Thanksgiving Recess	No Classes	Thursday-Saturday November 26–28
Final Examination Period for Fall Quarter		Monday-Saturday December 14–19

Winter Quarter 1982**Classes Begin Monday, January 4, 1982****WINTER REGISTRATION DATES**

Boston	5:00–8:00 p.m.	Monday-Thursday December 7–10
	5:00–7:00 p.m.	Friday, December 11
Burlington	5:00–8:00 p.m.	Monday-Thursday December 7–10
Belmont H.S.	5:30–8:00 p.m.	Tuesday, December 8
Brockton H.S.	5:30–8:00 p.m.	Wednesday, December 9
Framingham North H.S.	5:30–8:00 p.m.	Monday, December 7 and Tuesday, December 8
Marshfield H.S.	5:30–8:00 p.m.	Tuesday, December 8
Milford H.S.	5:30–8:00 p.m.	Tuesday, December 8
Norwood Jr. H.S. North	5:30–8:00 p.m.	Monday, December 7 and Wednesday, December 9
Reading (Austin Prep.)	5:30–8:00 p.m.	Tuesday, December 8
Revere (Abraham Lincoln School)	5:30–8:00 p.m.	Tuesday, December 8
Sandwich H.S.	5:30–8:00 p.m.	Wednesday, December 9
Westwood H.S.	5:30–8:00 p.m.	Tuesday, December 8
Weymouth North H.S.	5:30–8:00 p.m.	Wednesday, December 9 and Thursday, December 10
Christmas Vacation	No Classes	Monday-Saturday December 21–January 2
Winter Quarter Classes Begin		Monday, January 4
Martin Luther King's Birthday	No Classes	Friday, January 15
Washington's Birthday Observed	No Classes	Monday, February 15
Final Examination Period for Winter Quarter		Monday-Saturday March 22–27
Spring Recess (or Make- Up Period for Lost Snow Days)		Monday-Saturday March 29–April 3

Spring Quarter 1982 Classes Begin Monday, April 5, 1982**SPRING REGISTRATION DATES**

Boston	5:00–8:00 p.m.	Monday-Thursday March 15–18
	5:00–7:00 p.m.	Friday, March 19
Burlington	5:00–8:00 p.m.	Monday-Thursday March 15–18
Belmont H.S.	5:30–8:00 p.m.	Tuesday, March 16
Brockton H.S.	5:30–8:00 p.m.	Wednesday, March 17
Framingham North H.S.	5:30–8:00 p.m.	Monday, March 15 and Tuesday, March 16
Marshfield H.S.	5:30–8:00 p.m.	Tuesday, March 16
Milford H.S.	5:30–8:00 p.m.	Tuesday, March 16
Norwood Jr. H.S. North	5:30–8:00 p.m.	Monday, March 15 and Wednesday, March 17
Reading (Austin Prep.)	5:30–8:00 p.m.	Tuesday, March 16
Revere (Abraham Lincoln School)	5:30–8:00 p.m.	Tuesday, March 16
Sandwich H.S.	5:30–8:00 p.m.	Wednesday, March 17
Westwood H.S.	5:30–8:00 p.m.	Tuesday, March 16
Weymouth North H.S.	5:30–8:00 p.m.	Monday, March 15 and Wednesday, March 17
Spring Quarter Classes Begin		Monday, April 5
Patriots' Day Observed	No Classes	Monday, April 19
Memorial Day Observed	No Classes	Monday, May 31
Final Examination Period for Spring Quarter		Monday-Saturday June 14–19
Commencement		Sunday, June 20

Summer Quarter 1982 Classes Begin Monday, June 21, 1982**REGISTRATION FOR ENTIRE SUMMER QUARTER**

Boston	5:00–8:00 p.m.	Tuesday-Friday June 1–4
Burlington	1:00-8:00 p.m.	Tuesday, June 1
	5:00–8:00 p.m.	Wednesday, June 2

Summer Quarter Classes Begin**Monday, June 21****REGISTRATION FOR SECOND FIVE-WEEK TERM**

Boston	5:00–8:00 p.m.	Monday, July 19 and Tuesday, July 20
Burlington	5:00–8:00 p.m.	Monday, July 19
Independence Day Observed	No Classes	Monday, July 5
Labor Day Observed	No Classes	Monday, September 6
Final Examination Period for Summer Quarter		Held During Last Class Session of Each Term

Equal Opportunity Policy

Northeastern University is committed to a policy of providing equal opportunity for all. In all matters involving admissions, registration, and all official relationships with students, including evaluation of academic performance, the University insists on a policy of nondiscrimination. Northeastern University is also an equal opportunity employer; it is institutional policy that there shall not be any discrimination against any employee or applicant for employment because of race, color, sex, age, national origin, or on the basis of being a handicapped but otherwise qualified individual. In addition, Northeastern takes affirmative action in the recruitment of students and employees. Inquiries concerning our equal opportunity policies may be referred to the University Affirmative Action Officer and or the Title IX coordinator.

Emergency Closing of the University

Northeastern University has made arrangements to notify students, faculty, and staff by radio when it becomes necessary to cancel classes because of extremely inclement weather. Radio stations WBZ, WEEI, WHDH, WJDA, WCOP, WRKO, WLYN, WKOX, WHAV, and WLLH will announce the University's decision to close.

Office of Services for the Handicapped

The Office of Services for the Handicapped (OSH) provides a variety of support services and general assistance to all Northeastern's disabled students and employees. The University's efforts to comply with the Rehabilitation Act of 1973 are coordinated by Ruth Bork, OSH Director, 5 Ell Center, (617) 437-2675.

Affirmative Action Compliance

Northeastern's efforts to comply with the Title IX Education Amendments of 1972 are coordinated by Ellen Jackson, Dean and Director of Affirmative Action, 175 Richards Hall, 617-437-2133.

Delivery of Services

The University assumes no liability, and hereby expressly negates the same, for failure to provide or delay in providing educational or related services or facilities or for any other failure or delay in performance arising out of or due to causes beyond the reasonable control of the University, which causes include, without limitation, power failure, fire, strikes by University employees or others, damage by the elements, and acts of public authorities. The University will, however, exert reasonable efforts, when in its judgment it is appropriate to do so, to provide comparable or substantially equivalent services, facilities, or performance, but its inability or failure to do so shall not subject it to liability.

Important Note to Students

The Northeastern University catalog contains *current information* regarding the University calendar, admissions, degree requirements, fees, and regulations, and such information is not intended to be and should not be relied upon as a statement of the University's contractual undertakings.

Northeastern University reserves the right in its sole judgment to promulgate and change rules and regulations and to make changes of any nature in its program, calendar, admissions policies, procedures and standards, degree requirements, fees, and academic schedule whenever it is deemed necessary or desirable, including, without limitation, changes in course content, rescheduling of classes, cancelling of scheduled classes, and other academic activities, and requiring or affording alternatives for scheduled classes or other academic activities, in any such case giving such notice as is reasonably practicable under the circumstances.

We at Northeastern will do our best to make available to you the finest education we can provide, the most stimulating atmosphere in which to learn, and the most congenial conditions under which you may enjoy the learning experience. But the quality and the rate of progress of your academic career is in large measure dependent upon your own abilities, commitment, and effort. You will be a full participant in an educational partnership. We will, and indeed can, only make the opportunities available to you; it is up to you to take advantage of them.

This is equally true with your career upon graduation. We cannot guarantee that you will obtain any particular job; that will depend upon your own skills, achievement, presentation, and other factors such as market conditions at that time. Similarly, in many professions and occupations there are increasing requirements imposed by Federal and state statutes and regulatory agencies for certification or entry into a particular field. These may change during the period of time when you are at Northeastern, and they may vary from state to state. While we will be ready to help you remain up to date regarding these requirements and changes, it is your responsibility to initiate all inquiries. We cannot know what your expectations and understandings are unless you tell us.

In brief, we are here to offer you educational opportunities and choices and to assist you in finding the direction in which you want to steer your educational experience. But you are a partner in this venture with an obligation and responsibility to yourself.



the university

Founded in 1898, Northeastern University is incorporated as a privately endowed, nonsectarian institution of higher learning under the General Laws of Massachusetts. The State Legislature, by special enactment, has given the University general degree-granting powers. The University is governed by a Board of Trustees elected by and from the Northeastern University Corporation, which is composed of almost 180 distinguished business and professional men and women.

From its beginning, Northeastern University has had as its dominant purpose the discovery of community educational needs and the meeting of these needs in distinctive and serviceable ways. The University has not duplicated the programs of other institutions, but has sought to pioneer new areas of educational service.

A distinctive feature of Northeastern University is its Cooperative Plan, initiated by the College of Engineering in 1909 and subsequently adopted by the Colleges of Business Administration (1922), Arts and Sciences (1935), Education (1953), Pharmacy (1962), Nursing (1964), Boston-Bouv   College (1964), Criminal Justice (1967), and by Lincoln College's Engineering Technology Programs (1971). As an educational method, the Cooperative Plan offers students the opportunity to gain valuable practical experience as an integral part of their college programs, and also provides the means by which they may contribute to the financing of their education. The Plan has been extended to the graduate level in engineering, mathematics, actuarial science, rehabilitation administration, professional accounting, business administration, and law.

In the field of adult education, programs of study have been developed to meet a variety of needs. Since 1906, evening curricula have been offered leading to the bachelor's degree. Programs in the arts and sciences, engineering, various fields of business, law enforcement and security, and other areas have been carefully planned to serve mature students who are employed full time during the day and want to broaden their educational background by part-time study. All formal courses of study leading to degrees through evening programs are approved by the Basic College faculties concerned and are sub-

ject to the same quantitative and qualitative standards as the regular day curricula.

UNDERGRADUATE COLLEGES

Boston-Bouvé College of Human Development Professions

Boston-Bouvé College offers four major programs of study: physical education, recreation and leisure studies, and health education, leading to the degree of Bachelor of Science in Education; and physical therapy, leading to the degree of Bachelor of Science in Physical Therapy.

The combined programs of liberal arts, science, and professional preparation include field experience and student teaching, as well as leadership training in camping and outdoor education at the Warren Center for Physical Education and Recreation in Ashland. In accordance with Northeastern's Cooperative Plan of Education, students are offered varied opportunities for alternate terms of work-study experience during upperclass years.

College of Business Administration

The College of Business Administration offers programs of study in principal fields of business leading to the Bachelor of Science degree in Business Administration. These programs are offered on the five-year Cooperative Plan, under which students have the opportunity to gain substantial practical experience as an integral part of their undergraduate course of study.

The College also sponsors a Center for Management Development, which annually conducts intensive programs designed to provide professional growth for experienced managers. The plan of instruction, based on a modification of the Northeastern cooperative program, permits the participants to maintain their job responsibilities during the five-month period of the course. The Management Development Program is conducted at Andover, Massachusetts, on the campus of Phillips Academy. The Center also conducts management workshops, scheduled on 12 Fridays and offering four core areas of management study.

The Bureau of Business and Economic Research provides administrative assistance to research projects carried out under faculty leadership and supervision.

College of Criminal Justice

The College of Criminal Justice offers a full-time day curricula on the Cooperative Plan, leading to the degree of Bachelor of Science.

College of Engineering

The College of Engineering offers five-year cooperative curricula in civil (including an environmental engineering option), mechanical, electrical (including a power systems option and a computer engineering option), chemical, and industrial engineering leading to the degree of Bachelor of Science with spec-

ification according to the engineering department in which the student qualifies. A more general program without specification leading to the Bachelor of Science degree is offered in which students design their curriculum around a core of science, engineering science, and engineering courses. The College of Engineering also awards, on a joint basis with the College of Arts and Sciences, a Bachelor of Science degree in Computer Science. For highly qualified students, most departments offer a five-year program leading to both Bachelor's and Master's degrees; students carry course overloads beginning in the third year. The College also offers, during evening hours, part-time programs leading to Bachelor of Science degrees in Civil, Mechanical, and Electrical Engineering, extending over eight years and meeting the same qualitative and quantitative standards of scholarship as the day curricula.

College of Arts and Sciences

The College of Arts and Sciences offers majors in the arts and sciences leading to the Bachelor of Arts or Bachelor of Science degree. Curricula are normally four years in length on a full-time plan or five years in length on the Cooperative Plan.

Lincoln College

Lincoln College offers engineering technology programs leading to the Associate in Engineering, the Associate in Science, and the Bachelor of Engineering Technology degrees. These programs are made available as:

- (a) A full-time day curricula on the Cooperative Plan leading to the degree of Bachelor of Engineering Technology (B.E.T.) in Mechanical or Electrical Engineering.
- (b) A part-time evening program including pretechnology preparatory courses and degree programs leading to the Associate in Engineering (A.E.); and the Bachelor of Engineering Technology (B.E.T.) in Civil, Mechanical, or Electrical Engineering.
- (c) Lincoln College part-time students whose work schedule does not permit them to attend regular evening classes may register for a maximum of eight quarter hours of course work per quarter in the Lincoln College day program.

Registration materials will be available Monday through Friday in Room 408 Churchill Hall, Boston Campus only, during the week preceding the start of each quarter. The day class schedule will not be available at other campus locations. The Registrar will not accept registration materials for day classes without the approval of the Director of Lincoln College. Tuition will be billed at normal evening part-time rates.

The day B.E.T. program is designed to meet the needs of the high school graduate or the student transferring from a community college or technical institute, and who desires the full-time day curricula on the Northeastern Cooperative Plan.

In addition to its traditional curricula, Lincoln College Evening School offers interdisciplinary programs providing technological and professional development opportunities to meet special needs of the part-time student. These programs are designed to provide trained people for ready assimilation by the engineering field and to give students the opportunity to prepare for the challenge of interfacing technology and society.

College of Nursing

The College of Nursing offers two programs on the Cooperative Plan:

- (a) An option is offered to the licensed practical nurse to earn an Associate in Science degree in Nursing during a two-year period. Candidates for this program are not required to have cooperative education experiences.
- (b) A five-year curriculum (with seven cooperative education periods) leading to a Bachelor of Science degree in Nursing.

Each of the above qualifies graduates to write the Commonwealth of Massachusetts licensing examination for registered nurses.

The baccalaureate program provides registered nurses the opportunity to earn a Bachelor of Science degree in Nursing. In the event of sufficient nursing-working experience, cooperative periods are waived.

Cooperative education experiences and clinical nursing laboratories are provided by approximately 25 metropolitan and suburban hospitals.

College of Pharmacy and Allied Health Professions

The College of Pharmacy and Allied Health Professions offers five-year cooperative curricula leading to the degree of Bachelor of Science in Pharmacy, Bachelor of Science in Respiratory Therapy, Bachelor of Science in Toxicology, and to the Bachelor of Science degree with majors in medical laboratory science and medical record administration. Associate degree programs are offered in medical laboratory technology, respiratory therapy, and dental hygiene. The College has academic responsibility and, in cooperation with the medical schools and teaching hospitals in the Boston area, offers the professional program for physician assistants.

University College

University College, so called because it draws upon the resources of the other colleges of the University, offers part-time day and evening programs in arts and sciences, business administration, law enforcement, education, health professions, and therapeutic recreation service programs, leading to the Associate in Science, Bachelor of Arts, and Bachelor of Science degrees. It does not duplicate the offerings of the day colleges, but provides curricula which cut across traditional subject-matter areas to meet the particular needs of adult students. Students may pursue a degree or simply take courses, based on needs and interests, up to a total of 39 or 40 quarter hours of credit. Courses

are offered in Boston as well as in Burlington, Framingham, Milford, Revere, Weymouth, Brockton, Norwood, Marshfield, Sandwich, Belmont, Westwood, and Reading.

Adult Day Programs refer to University College courses offered Monday through Friday, 9:00 a.m. to 5:00 p.m., to meet the needs of adults with family or other obligations who wish to engage in part-time study during the day. In addition to the daytime offerings of regular University College credit courses, Adult Day Programs also offer workshops and conferences, sometimes over weekends, with the option for credit. Adult Day Programs are offered primarily on the Boston and Burlington Campuses, with a limited number of courses offered at other off-campus locations.

Students may enroll as degree candidates or elect single courses appropriate to their needs and interests. Courses are scheduled in the day and evening at the Boston Campus, Suburban Campus in Burlington, and other off-campus locations near Boston.

GRADUATE SCHOOLS

Arts and Sciences

The Master of Arts degree may be earned in economics, English, history, political science, psychology, and sociology. The Master of Science degree is available in biology, chemistry, economic policy and planning, mathematics, and physics. The Master of Science in Health Science and the Master of Public Administration degrees are also offered. In addition, there are programs leading to the Doctor of Philosophy degree in biology, chemistry, economics, mathematics, physics, psychology, and sociology.

Boston-Bouvé College of Human Development Professions

Master of Science with specialization in Physical Education, Physical Therapy, or Recreation and Leisure Studies; Master of Education; Doctor of Education; and, the Certificate of Advanced Graduate Study.

Business Administration

Master of Business Administration.

Criminal Justice

Master of Science in Criminal Justice; Master of Science and Doctor of Philosophy in Forensic Chemistry offered in conjunction with the Institute of Chemical Analysis, Application, and Forensic Science.

Engineering

Master of Science degrees are offered with course specifications in the fields of Civil, Chemical, Electrical, Industrial, Mechanical, Transportation, and Engineering Management. A six-year program leading to both a Bachelor's and Master's degree is offered in Electrical Engineering, Mechanical Engineering, and Power Systems. Professional Engineers degrees are offered in Electrical, Industrial, and Mechanical Engineering. Ph.D. degrees are offered in Civil, Chemical, Electrical, and Mechanical Engineering. A Doctor of Engineering degree in Chemical Engineering is offered in addition to the Ph.D.

Law

The School of Law offers a full-time program of professional instruction leading to the degree of Juris Doctor (J.D.). The three-year curriculum includes 12 months of professional experience in law offices, governmental agencies, or other law-related employment. There are no courses for part-time or evening students.

Pharmacy and Allied Health Professions

Master of Science with specialization in Clinical Chemistry, Hospital Pharmacy, Medical Chemistry, Pharmacology, Medical Laboratory Science, and Radiopharmaceutical Science. Doctor of Philosophy in Medicinal Chemistry with specialization in Biopharmaceutics, Clinical Chemistry, Medical Laboratory Science, Pharmacology, and Radiopharmaceutical Science, as well as an Interdisciplinary Doctor of Philosophy program in Forensic Chemistry.

Professional Accounting

A five-quarter curriculum leading to the degree of Master of Science in Accounting.

Some of the above programs are offered on the Cooperative Plan; others provide teaching and research fellowships for able candidates. The graduate schools are under the jurisdiction of the basic college deans.

CENTER FOR CONTINUING EDUCATION

The Center for Continuing Education was established to relate the University to the needs of its community in a period of accelerated change. Its programs are composed of seminars, conferences, institutes, forums, and a wide variety of special courses designed to serve specific needs. The Division of Special Programs, working cooperatively with trade associations and professional societies, offers a wide variety of programs dealing with current needs and problems. Through its Division of Community Services, working with governmental agencies and community organizations, the Center is becoming increasingly involved in social problems on both the local and national level.

Many of these programs are conducted at Henderson House, Northeastern University's conference center in Weston, Massachusetts.

OFFICE OF LEARNING RESOURCES

The Office of Learning Resources provides faculty, students, and staff with a variety of instructional services, equipment, and learning facilities.

The Learning Center furnishes students with individualized study and language lab facilities for remedial, supplementary, or enrichment purposes in many subject areas and in many formats—programmed texts, audiotapes, videotapes, and sound filmstrips, among others. A listening lounge, equipped with a stereophonic sound system, supplies a large selection of classical and popular prerecorded music. Students may use all facilities independently or to complete class assignments at no cost during day, evening, and weekend hours.

The Learning Resources Center is located in 406 Dodge Library and is open seven days a week. Telephone 437-2465 for further information.

The Media Production Laboratory provides facilities for both students and faculty for producing original materials, such as overhead transparencies, audiotapes, illustrations, slides, posters, and charts. Training is given in the use of all equipment, including that used for television production.

Campus Media Services makes available all types of audiovisual and video equipment and instructional materials for the support of classroom instruction on a prescheduled basis. Certain equipment is reserved for student use, and students may borrow instructional materials with faculty approval. A catalog of all instructional materials is available at no charge.

The Instructional Materials Center, which acquires and maintains the collection of University-owned instructional materials, also provides a rental service for 16mm films and videotapes obtained from outside sources. Faculty who would like to evaluate instructional materials before purchase may do so through its preview service and facilities.

The Instructional Development Center assists individual faculty with specifying instructional goals, reviewing related literature and materials, examining alternative teaching strategies, producing learning materials, and evaluating course effectiveness. Its training in presentation and teaching techniques is complementary to its basic function of developing instructional units and courses.

DAY PROGRAMS FOR ADULTS

These programs were developed to meet the needs of adults who wish to engage in part-time study during the day only. Noncredit courses and undergraduate and graduate degree programs are offered at the Boston and Burlington campuses. Included are courses from the graduate Boston-Bouv  College of Human Development Professions, the Graduate School of Arts and

Sciences, University College, and the Center for Continuing Education. A Human Relations and Adult Counseling Program is also offered.

AFFILIATED PROGRAMS

Dental Hygienists

The Forsyth School for Dental Hygienists conducts a two-year program of dental hygiene education and general education in cooperation with Northeastern University. Graduates receive the Certificate in Dental Hygiene from Forsyth and the degree of Associate in Science from Northeastern University. After receiving the Associate degree, students may pursue the Bachelor of Science degree from University College on a part-time basis.

Aeronautical Technology

Lincoln College conducts full-time day programs in Aeronautical Technology in which the student earns the Associate in Science degree and may become licensed by the Federal Aviation Administration with commercial, instrument, and instructor pilot ratings.

Health Record Administration

The University, in affiliation with several area hospitals, offers a three-year part-time evening program leading to certification in Health Record Administration for students who already hold a Bachelor's degree and wish to qualify for the professional examination leading to registration as a record librarian.

Medical Technologists, Cytotechnologists, Hematologists

In cooperation with area teaching hospitals, Northeastern University offers a full-time day program on the Cooperative Plan leading to the degree of Bachelor of Science with concentration in Medical Technology.

Bachelor of Science degree programs in Medical Technology and Hematology, and an Associate degree in Cytotechnology, are offered on a part-time basis by University College in cooperation with several approved hospital schools.

Nurses

Northeastern University offers instruction in the sciences, humanities, and social studies for student nurses working for their Associate or Baccalaureate degree.

Physician Assistants

In cooperation with the Massachusetts Medical Society, Northeastern offers an 18-month program for the primary care physician assistant. Clinical rotations, supplemental to courses taken on campus, take place at Boston-area hospitals.

Radiologic Technologists

University College, in collaboration with several American Medical Association affiliated hospitals in the New England area, conducts a program leading to eligibility for certification as a registered Radiologic Technologist and the Associate in Science degree. The program is accredited by the Joint Review Committee on Education in Radiologic Technology of the American Medical Association.

Respiratory Therapists

This program is conducted by the College of Pharmacy and Allied Health Professions in affiliation with local hospitals.



buildings and facilities

Main Campus

The main campus of Northeastern University is located at 360 Huntington Avenue in the Back Bay section of Boston. Many of the city's famous cultural, educational, and philanthropic institutions are situated in the Back Bay, including the Museum of Fine Arts, Symphony Hall, Horticultural Hall, the Isabella Stewart Gardner Museum, the Harvard teaching hospitals, and many schools and colleges. Most are within walking distance of Northeastern University.

Major transportation facilities serving the Boston area are Logan International Airport, two rail terminals, bus terminals serving inter- and intrastate lines, and MBTA subway-bus service within the metropolitan-suburban area. There is a subway stop in front of the campus. For motorists, the best routes to the campus are the Massachusetts Turnpike (Exit 22) and Route 9, of which Huntington Avenue is the intown section.

The campus of 50 acres is divided by Huntington Avenue, with the main educational buildings on one side and dormitories on the other. The principal buildings, all of which have been constructed since 1938, are of glazed brick in contemporary classic style. Some are interconnected by underground passageways.

Carl S. Eli Student Center

The Carl S. Eli Student Center provides facilities for student recreation and for extracurricular activities. The Alumni Auditorium, with a seating capacity of 1,300, is part of the Center. Also included are special drama facilities, a ballroom, main lounge, fine arts exhibition area, student offices, conference rooms, and a dining area seating more than 1,000.

University Library System

The University Library System includes the Dodge Library and the three graduate libraries: Chemistry, 112 Hurtig Hall, which includes Chemical Engineering, Biology, Pharmacy, and the Health Sciences; Physics/Electrical Engineering, 324 Dana Hall; and Mathematics/Psychology, 531 United Realty Building. The Suburban Campus Library supports the programs at Burlington. Other collections are Marine Science at Nahant, Center for Management Development at Andover, and Aeronautical Technology at Norwood. There is also the Law Library, located in the Knowles Center, and the Curriculum Resources Library in Cahners Hall.

The University Library collections number more than 450,000 bound volumes and 500,000 microform volumes. The periodical titles number 4,000, additional continuation titles 1,243, and sound recordings 10,000.

1. The Reference Collection in the Cabot Reading Room on the main floor of the Dodge Library contains 20,000 volumes. This collection is of major importance to anyone using the library. The researcher should be aware of the source books, handbooks, bibliographies, and similar aids before beginning an investigation of the literature.

The Reference Division includes the Government Documents Collection located in 14 Dodge, and the Microforms Collection located in 108 Dodge. Additional sources of information are the Business Services, Technical Reports, Annual/Company Reports, and the Information File for pamphlet materials.

2. The Periodical Collection in the Webster Reading Room on the main floor consists of Indexing and Abstracting Services, and the current periodicals mainly in literature, humanities, social sciences, and general science, as well as foreign and domestic newspapers.

This collection supports the Reference Collection and updates the General Collection by encompassing the latest developments in all fields of knowledge.

The Periodical Stacks are adjacent to the collection and are serviced by the library staff.

3. The General Collection is located on the three floors and two stack levels of the Dodge Library indicated by posted floor plans and guides available at the Information Desk.
4. The Reserve Book Collection is located in 204 Dodge. This is an important and widely used collection of textbooks and assigned reading to support the classroom lecture and laboratory, and for further in-depth information.
5. The Public Catalog located on the main floor includes author, title, and subject cards for the foregoing collections, except for documents, technical reports, and complete entries for periodicals which will be found in catalogs in those areas. The Public Catalog includes both the Dewey Decimal classification and the Library of Congress classification.
6. The Circulation Department manages the organization of the General Collection. Materials are charged out and returned at the Circulation Desk. A daily computer printout of items on loan is available to assist in locating books not found on the shelves.
7. The Inter-Library Loan Department is located in 18 Dodge. This service should be used for materials not available in the system and for serious research.
8. The Music Reference Service is located in 406 Dodge. This collection of books, scores, records, and tape cassettes is for assigned listening and personal enjoyment. The collection contains both music and spoken word.
9. The Learning Center, 406 Dodge, is a service for programmed and language instruction utilizing audio/visual/video equipment teaching programs to support classroom work and independent study.
10. It should be understood that the Divisional Libraries, the Burlington Campus Library, and the Law School Library have the same services and card

catalogs as the main Dodge Library with respect to their specific academic disciplines.

LIBRARY HOURS

Dodge Library

Mon.—Thurs.	7:45 a.m. to 10:00 p.m. (10:00 p.m. to midnight)*
Friday	7:45 a.m. to 7:30 p.m.
Saturday	12:00 noon to 5:00 p.m. (5:00 p.m. to 10:00 p.m.)*
Sunday	12:00 noon to 5:00 p.m. (5:00 p.m. to midnight)*

* References and Periodicals; for study only.

Divisional Libraries

Mon.—Friday	8:30 a.m. to 10:00 p.m.
Saturday—Sunday	Closed

Suburban Campus Library, Burlington

Mon.—Thurs.	8:30 a.m. to 9:00 p.m.
Friday	8:30 a.m. to 7:00 p.m.
Saturday	8:30 a.m. to 1:00 p.m. (alternate Saturdays)
Sunday	Closed

Cabot Physical Education Center

The Godfrey Lowell Cabot Physical Education Center is one of the best equipped in New England. It contains four basketball courts, an athletic cage, a women's gymnasium, and a Nautilus room, as well as administrative offices for the Department of Athletics and for the Physical Education Department of the Boston-Bouvé College of Human Development Professions.

The Barletta Natatorium houses a 105-foot swimming pool, a practice tank for the crew, handball courts, and shower and dressing facilities.

Dockser Hall

Charles and Estelle Dockser Hall, completed in 1968, houses a large gymnasium, dance studio, motor performance laboratory, library, community recreation laboratory, folk arts center, darkroom, recreation resources area, locker rooms, offices, classrooms, conference room and lounge, storage facilities, and a research laboratory.

SUBURBAN FACILITIES

Suburban Campus

The Suburban Campus, located near the junction of Routes 128 and 3 in Burlington, Massachusetts, was established to meet the needs of individuals and of industry in the area.



In addition to graduate courses in engineering, physics, mathematics, business administration, science, education, and the arts, portions of undergraduate programs leading to the Associate and Bachelor's degrees, special programs for adults, and noncredit state-of-the-art programs are offered.

Henderson House

The University's conference center, Henderson House, is located in Weston, Massachusetts. The Center for Continuing Education conducts short-term courses, seminars, and special institutes for business, professional, and research groups. Henderson House is 12 miles from the main campus.

Warren Center

The Warren Center for Physical Education and Recreation in Ashland, Massachusetts, serves as a year-round outdoor laboratory for students in Boston-Bouvé College. There are facilities for conferences, special education in arts and crafts, and sports—including aquatics. Buildings include a lodge, cottages, and an infirmary.

Marine Science Institute

The Marine Science Institute at Nahant, Massachusetts, located about 20 miles northeast of Boston, is a research and instruction facility engaged primarily in studies of marine biology and oceanography. The Institute is operated all year.

lincoln college administration

Administrative Officers

William F. King, B.S., M.S., P.E.

Director

Jacob Wiren, B.S., M.S., P.E.

Assistant Director

Rasma Galins, B.S.

Assistant to the Director

Student Counseling Staff

Jacob Wiren

Administrative Coordinator

Robert J. Averill, B.S., M.S.

Boreslaw P. Berestecky,

B.S.M.E., M.Ed.

Philip W. Dunphy, B.S., M.Ed.

Peter Franks, B.A., M.Ed.

Richard E. Sprague, B.S., B.B.A.,

M.B.A., Ed.M.

Kenneth S. Woodard, B.S., M.E.,

A.G.I.I.G.I. (Federal)

David R. Fraizer, B.S.

Committee on Regulations and Discipline

William F. King, *Chair*

Kenneth S. Woodard

Kenneth C. Solano

Rasma Galins

President, Adult Student Council

Academic Standing Committee

Rasma Galins, *Chair*

William F. King

Jacob Wiren

Ernest E. Mills

Louis J. Nardone

Academic Advisory Council

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Jacob Wiren, *Vice Chair*

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AVCO Everett Research Lab.
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Engineer
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(Academic Administration)

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(Mechanical Engineering Electives)

Edward Bobroff, B.M.E.
(Program Consultant, Mathematics)

Eugene G. Branca, S.B., S.M.
(Basic Mathematics)

Franklyn K. Brown, B.S., M.Ed.
(Engineering Design)

Leroy M. Cahoon, B.S.C.E., M.S., P.E.
(Program Consultant, Civil Engineering Technology)

Robert W. Case, Ph.D.
(Coordinator, Day Mathematics)

Roger T. Connor, A.B., M.Ed.
(Course Consultant, Calculus)

William V. Durante, B.S., M.Ed., M.A.
(Freshman Mathematics)

William D. Finan, A.B., M.A., D.Ed.
(Introductory Mathematics)

Peter D. Gianino, B.S., M.S.
(Differential Equations)

David Goldberg, B.S., M.S.E.E., M.S.E.M.
(Electrical & Electronic Graphics)

Francis R. Hankard, S.B., M.A.
(Program Consultant, Physics)

Joseph J. Hansen, A.B., M.B.A.
(Mathematics for Business Mgmt.)

John Kaczorowski, Jr., B.S., M.S.
(Electronic Labs.)

George F. Kent, B.S., M.S., P.E.
(Materials)

Robert S. Lang, B.S., Ed.M.
(Engineering Graphics)

Demetre P. Ligor, B.S.E.E., P.E.
(Course Consultant, Physics)

Bertram S. Long, B.S., M.S., M.E.
(Stress Analysis, Adv. Stress Analysis)

Anton Mavretic, B.S., M.S., Ph.D.
(Linear Active Cir. Des., Electronics, & Prin. of Comm. Systems)

Robert L. Meserve, B.S., M.S.
(Fluid Mechanics)

Walter Messcher, B.M.E., M.S.
(Program Consultant, Computer Technology)

Ernest E. Mills, B.S., M.S., P.E.
(Program Consultant, Mechanical Engineering Tech., Day and Evening Programs)

Louis J. Nardone, B.S., M.S., P.E.
(Program Consultant, Electrical Engineering Technology, Day and Evening Programs)

Charles H. Price, Jr., B.S.E.E., M.S.E.E.
(Analog, Digital & Hybrid Computers, Digital Systems)

Ralph W. Sexton, B.S., M.S.P.E.
(Mechanical Tech. Laboratory)

Raimundas Sukys, B.S., M.S.
(Pulse Circuits, Integrated Circuits)

Joel Weinstein, B.S.
(Microprocessor Hardware)

Albert G. Wilson, Jr., B.S.C.E.,
M.S., P.E. (Mass.), S.E. (Illinois)
(Statics and Dynamics)

Office Staff

Karen K. Rodi, Administrative Secretary
Elsie Chan, Secretary of Exams
Carol M. Anselment, Secretary of Records
Janet A. Abdel-Rehim, Secretary



the role and scope of lincoln college

Purpose

Lincoln College is charged with the responsibility for developing and offering college-level courses and curricula of an applied-science or technological nature. Its purpose is to assist professional personnel, qualified to deal with the applications and uses of the biological, natural, and physical sciences in better meeting community needs. The programs of study conducted by the College have in common the following purposes and characteristics:

1. The programs of instruction offer the student the opportunity to prepare for activities allied to the fields of engineering, science, or medicine, but are more specialized than those required to prepare a person for full professional responsibilities.
2. The programs of instruction are more concise and more completely technological in content than professional curricula, although they are concerned with the same general fields of scientific, engineering, industrial, or clinical specialization.
3. The programs of instruction are based upon principles of science, and include post-secondary school mathematics to provide the tools to achieve the technological objectives of the curricula.
4. Emphasis is placed upon the use of rational processes in converting theories and ideas into practical techniques, procedures, and products.
5. Extensive training for artisanship or craftsmanship is not included within the scope of the technological education programs.
6. Graduates from the Associate degree programs have opportunities for educational work leading to the Bachelor of Engineering Technology and Bachelor of Science degrees.

Technology and the Technologist

Scientific and technological skills range over a broad spectrum, from extremely simple craftsmanlike activity to highly complex and abstract activity. At one end of the spectrum is the professional whose work is mostly theoretical in character. He or she studies, reasons, and visualizes how new knowledge may be used in the development of solutions to technical problems. This person usually is not completely knowledgeable in the detailed procedures used by the skilled craftsman who executes the ideas, procedures, and designs.

The technologist is the pivot-person on the professional-technologist-craftsman team. The technologist usually works with the professional engineer, sci-

entist, doctor, supervisor, and craftsman in converting knowledge of scientific theories and practical craftsmanship into products, procedures, and techniques.

When employed in research, design, or development, the technologist usually acts as direct supporting personnel to the professions. Functioning in a capacity related to production, operation, testing, or control, he or she usually follows a course prescribed by a professional, but may not work closely under the professional's direction. If installation, maintenance, or sales are the areas of responsibility, the technologist is frequently performing a task that would otherwise have to be performed by the professional, thereby assuming the more routine professional functions demanded by our increasingly scientific and technical society.

In executing all functions, the technologist is normally required to use a high degree of rational thinking, to employ post-secondary school mathematics and the principles of the biological, natural, and physical sciences. The skilled technologist works with the mind as well as the hands, and considers why, as well as how, things work. The technologist must effectively communicate technical and scientific information mathematically, graphically, and linguistically.

The Need for Technologists

Our present technological age, with its exploding accumulation of new information and discoveries in the physical, natural, and life sciences, has increased the need for people with specialized training in science and technology. Experts have recently estimated that in order to meet expanding needs, the number of students graduating from the nation's professional schools must double—a goal which is improbable in the near future.

The most reasonable alternative is to make our professional manpower most efficient by providing assistance in the form of specially trained technologists. Manpower experts believe that the present ratio of less than one technologist to each professional should ideally be nearer five to one.

Opportunities for technologists are increasing. The technologist's employment opportunities are varied and include positions in health and public service organizations; atomic energy and electric power industries; metal fabricating industries; local, state, and Federal government agencies; the armed forces; aerospace industries; chemical, petroleum, plastics, and metal industries; and transportation and communication industries, among others.

PROGRAMS OF INSTRUCTION

Recognizing the growing need for technicians and technologists and their expanding role in modern society, Lincoln College offers Pre-Technology Preparatory Courses and degree programs leading to the Associate in Engineering (A.E.), Associate in Science (A.S.), and Bachelor of Engineering Technology (B.E.T.) degrees as follows:

Pre-Technology

Introductory Mathematics, Basic Mathematics, Physics, and English	pages 66–67
Reading Improvement Program (noncredit)	page 67
Programmed Study Review Courses (noncredit)	page 67

Aeronautical Technology

Aeronautical Technology (A.S. degree)—2 years (days)	page 69
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Civil Engineering Technology

Architectural Engineering Technology (A.E. degree)	page 72
Environmental Engineering (A.E. degree)	page 73
Structural Engineering Technology (A.E. degree)	page 74
Surveying and Highway Engineering Technology (A.E. degree)	page 75
Civil Engineering Technology (B.E.T. degree)	page 77

Electrical Engineering Technology

Electrical Engineering Technology (A.E. degree)	page 81
Electrical Engineering Technology (B.E.T. degree)	page 83
Electrical Engineering Technology (B.E.T. degree) (Day Cooperative Curriculum)	page 86

Mechanical Engineering Technology

Mechanical Engineering Technology (A.E. degree)	page 89
Mechanical Engineering Technology (B.E.T. degree)	page 91
Mechanical Engineering Technology (B.E.T. degree) (Day Cooperative Curriculum)	page 94

Interdisciplinary Science and Engineering Technology Programs

Computer Technology (A.E. degree)	page 97
Computer Technology (B.E.T. degree)	page 99
Mechanical-Structural Engineering (B.E.T. degree)	page 102

COLLEGE OF ENGINEERING

Part-time Electrical, Civil, and Mechanical Engineering Programs (B.S. degree)

These programs are designed for fully qualified young men and women who:

1. because of family responsibilities must continue to be gainfully employed full time during the day, but who wish to advance by devoting leisure time to their own professional development;

2. were in the top half of their high school class, but at graduation were financially unable to continue their education at the college level; those who did not enjoy top-half standing may require refresher study;
3. realize that the most effective way to achieve their full potential in these days of specialization is to earn a college degree.

All courses in these part-time curricula are identical with those offered in the five-year, day cooperative programs and are taught by the same faculty.

The University reserves the right to withdraw, modify, or add to the courses offered or to change the order or content of courses in any curriculum.

Admission Requirements for the College of Engineering

It is important that applicants for admission to the College of Engineering complete the full sequence of secondary school courses in English, Mathematics, and Science. The following subjects should be included: English (four years), Physics or Chemistry, Algebra (through quadratics), Plane Geometry, and Trigonometry.

Admission testing requirements may be met in one of three ways:

1. by submitting the results of the College Board Scholastic Aptitude Test previously completed;
2. by writing the College Board Scholastic Aptitude Test during the current year; the Committee on Admissions provides full information about the Scholastic Aptitude Tests;
3. by completing a special battery of tests in the Northeastern University Counseling and Testing Center, Room 302, Ell Student Center.

A transfer student applying for advanced standing need not complete testing.

In evaluating the credentials of applicants, the Committee on Admissions takes into account additional study which may have been completed since secondary school and, where relevant, armed forces experience.

Applying for Admission to the College of Engineering

Applications for freshman admission and admission with advanced standing may be obtained by writing to the Department of Admissions, 150 Richards Hall, or they may be secured during an admissions interview.

A personal interview is not required, but all candidates are welcome to make an appointment with an admissions counselor. Interviews may be scheduled from 8:30 a.m. to 4:00 p.m., Monday through Friday, and on Saturday from 9:00 to 11:30 a.m.

The candidate will be notified of the decision of the Committee on Admissions as soon as all credentials have been received and evaluated.

Candidates who have successfully completed courses at other institutions and who wish to transfer to Northeastern should read the following information concerning special transfer programs.

Civil and Electrical Engineering Transfer Programs for Associate Degree Graduates

Students with an Associate degree from an accredited technical institute, community college, or junior college with a 2.5 cumulative average or better ($C = 2.0$) will be considered for admission to a special transfer program and complete the civil or electrical engineering degree in five years. Students whose Associate degree program did not include a minimum of one year of both calculus and physics will not be eligible for entry at this level.

Civil, Electrical, and Mechanical Engineering Transfer Programs for Bachelor of Engineering Technology Graduates

Students with a Bachelor of Engineering Technology degree or its equivalent from an accredited college or university, with a 2.75 cumulative average or better ($C = 2.0$), may be eligible to complete one of the specified Bachelor of Science in Engineering programs by taking a *minimum* of 40 quarter hours (10 courses) of work. The courses to be taken are assigned by a departmental adviser and are based whenever possible on the student's previous background. Students who have a Bachelor of Engineering Technology, Bachelor of Science in Engineering Technology, or a Bachelor of Science in Engineering degree that is not professionally accredited may be required to take significantly more courses.

All Other Transfers to the College of Engineering

Students with previous academic experience not covered in the above categories will be placed at an appropriate point in the program they select, based on a course-for-equivalent-course credit evaluation.

Questions concerning these programs may be referred to the Department of Admissions (437-2213), or to the Office of the Dean of the College of Engineering (437-2152).

The College Year

Each academic year is composed of three 12-week quarters, beginning late in September and ending about the middle of June. Full details with regard to registration are mailed approximately one month in advance. The programs are offered only at the Boston Campus.

Schedule of Classes

Class will normally meet two evenings each week, and occasionally on Saturday morning. Laboratory classes meet during additional evenings.



admissions information

ADMISSION

The Student Body

The student body of Lincoln College is composed of recent high school graduates and mature men and women. Most students are employed in industry, with vocational experience ranging from very little for the recent secondary school graduate, to as much as 20 or 30 years for individuals seeking increased professional responsibility and status. Many technical career categories are represented—industrial, engineering, scientific, and allied-medical—demonstrating that, in our increasingly complex society, the key to personal advancement is education.

Northeastern University is authorized under Federal law to enroll non-immigrant alien students.

Academic Background

A firm knowledge of the fundamentals of mathematics and science is the foundation upon which successful achievements in the more advanced technological courses are built.

Applicants to Lincoln College are, in many cases, mature adults who, although they have experience in industry or previous education, have been away from formal study for some time, and therefore have doubts concerning their study habits and their algebra, geometry, and science proficiency. Those who anticipate some difficulty in adjusting to the first-year course requirements are advised to give very serious consideration to enrolling in noncredit courses in introductory mathematics, introductory physics, and/or introductory chemistry. These courses are designed to develop adequate background for the basic courses in the degree programs.

Program Counseling

Career planning through self-analysis and professional counseling assists students in planning educational programs appropriate to their objectives. Entering students are encouraged to arrange for personal interviews with Lincoln College program counselors for assistance in planning their academic programs. Counselors are available by appointment at the Huntington Avenue Campus, Boston, and at the other Lincoln College campuses listed at the front of this catalog. Students are encouraged to present records of prior education whenever possible. The effectiveness of the counseling review is greatly enhanced by this information. The University, through its Counseling and Testing

Center and its Career Information Center, is also prepared to assist applicants whose educational and vocational goals are more complex or less firmly defined.

Application for Admission

Applications for the programs of study offered by Lincoln College are accepted for admission to the Fall (September), Winter (January), Spring (March), and Summer (June) Quarters. Applications should be filed as early as possible in advance of the opening of the quarter for which the student desires to register in order that eligibility and status may be established.

Information concerning admission may be obtained either by writing to Lincoln College or by requesting it at the time of visiting the College. The application for admission should be completed in detail and submitted to Lincoln College, Northeastern University, Boston, Massachusetts 02115.

All inquiries relative to the day cooperative programs should be referred to the Day College Admissions Office, 150 Richards Hall. (See pages 81 and 88.)

Mathematics Placement Test

Applicants requesting admission to regular first-year mathematics are required to demonstrate proficiency in introductory or basic mathematics through the Lincoln College Mathematics Placement Test. Students who request enrollment in the noncredit Introductory Mathematics course are not required to take the test. The Mathematics Placement Test will be administered during the registration period for each term of instruction at the Huntington Avenue campus, Boston, and the Suburban Campus, Burlington. The Mathematics Placement Test will be administered on selected dates at the Lincoln College campuses listed at the front of this catalog. In addition, the test is administered during the summer months. Contact the Lincoln College Office, 408 Churchill Hall, at the Boston Campus (437-2500).

Students who demonstrate satisfactory proficiency in the test will be permitted to register for the first-year courses in the program of their choice. To enroll in Engineering Physics (11.617) the student may need to take Introductory Physics.

If need for a strengthening of mathematical background is indicated, the applicant will be assigned to the Introductory Mathematics course.

Students enrolling in Introductory Mathematics may fill out their schedule by enrolling in Introductory Physics, Introductory Chemistry, or Engineering Graphics.

In every case the student should carefully consider the combined work and study load and register for only those courses which contribute to the development of a firm knowledge of fundamentals and which enable the student to adjust to academic study requirements.

CLASSIFICATION OF STUDENTS

Applicants who have filed an application for admission and who are approved by the Lincoln College Academic Standing Committee are admitted as regular students in the program which they have indicated on the application.

Special Students

Students having specific course needs, who do not desire a degree, may register for the courses if they have the required prerequisites or their equivalent. These students will be enrolled as “special students”.

Matriculation

Petition forms of admission to the status of a degree candidate are available at offices on all Lincoln College campuses (see page 45). There are two methods of matriculation:

- A. Standard Method of Matriculation
 1. A student who has completed 16 quarter hours of credit in Lincoln College must file a matriculation petition to be recognized as a degree candidate.
 2. The student must have a high school diploma or its equivalent and must achieve a cumulative quality point average of 2.00 (an average of C) for all courses completed before filing the petition.
- B. Optional Method of Matriculation by Transfer Students
 1. A student who has transferred 16 quarter hours of credit from another accredited institution may file for matriculation following one quarter in residence in Lincoln College.
 2. A student who has completed 16 quarter hours of combined credit transferred from another accredited institution and earned at Lincoln College may file for matriculation..

All students filing for matriculation must have a high school diploma or its equivalent.

The Committee on Academic Standing may require a student to take one or more aptitude tests or interest tests if his or her credentials or academic record fail to give evidence of probable academic success. In this case, the student will be notified in writing that arrangements for testing should be made with the University Counseling and Testing Center. A fee is charged for these tests.

TRANSFER STUDENTS AND ADVANCED STANDING CREDITS

Students transferring from community colleges, junior colleges, technical institutes, or other colleges and universities may transfer applicable credits toward the degree requirements of Lincoln College.

Students admitted with transfer or advanced standing credits from another institution must meet the requirements for admission as set forth under the regulations applicable to regular students. Advanced standing in Lincoln College may be obtained by (1) transfer of credits or (2) proficiency examination.

Transfer of Credits

Subject to the approval of the Academic Standing Committee, credits may be awarded for academic work completed in other approved schools, colleges,

or universities if the following criteria are met: (a) the content of the course being submitted is equivalent to that of the corresponding course in Lincoln College; (b) the average grade achieved in the course submitted is "C" or higher; and (c) the remoteness of the time of study does not negate its use as a prerequisite for an advanced course.

Applicants desiring advanced standing credit by transfer should indicate so at the time of filing the application for admission. The applicant should request the Registrar of the institutions of previous attendance to mail an official transcript to the Lincoln College Office.

Proficiency Examinations

Applicants who do not meet all the criteria for the normal transfer of credits, but who are able to supply evidence of sufficient knowledge of a subject as a result of previous training or experience, may petition the Academic Standing Committee for the privilege of taking a Proficiency Examination. If satisfactory proficiency is indicated by the examination, advanced standing credits may be awarded.

Readmission

Former students who seek readmission to continue a program of study after having withdrawn from the College for a period of time may be required to repeat courses which are prerequisites to advanced work.

REGISTRATION

Registration for Courses

Completion of admission requirements does not constitute official registration for courses. All students must be properly registered before attending classes. Registrations are processed by the Registrar's Office during the official registration periods. Former students should ascertain completion of prerequisite courses before registration. Students may register for full-year sequences of courses during the official registration periods. They are urged to register as early as possible in order to obtain the desired class schedule.

Changes in Registration

Changes in program should be initiated before the opening day of classes during the official registration periods.

Official Registration Periods

Official registration periods are scheduled before the Fall, Winter, Spring, and Summer Quarters during the academic year. Students are urged to register as early as possible during these periods. Dates of registration periods for each quarter are listed in the 1981-1982 Academic Calendar (see page 8).

Withdrawal

Simply ceasing to attend classes or notifying the instructor does not constitute official withdrawal from a course. To withdraw officially, the student must notify the Registrar's Office in writing or complete the appropriate withdrawal form. Properly registered students who do not attend one of the first three sessions in any course will be automatically withdrawn from the class roll.

Courses in Other Departments of the University

Lincoln College students assigned to courses in other departments of the University are charged the tuition rates and other fees effective in the departments in which they are enrolled.



academic information

ACADEMIC OPERATIONS

Campuses and Extensions

All courses are offered at the Huntington Avenue campus, Boston, with some courses available at the Suburban Campus, Burlington; Framingham North High School, Framingham; Norwood Junior High School North; Weymouth High Schools; and the Abraham Lincoln School in Revere; and for Aeronautical Technology students at the Suburban Campus, Burlington.

The Quarter Calendar

The regular school year, from September to June, is divided into three quarters of 13 weeks each. Twelve weeks are scheduled for instruction and final examinations, with one week available for makeup classes or vacation time. A limited program of courses is offered during the Summer Quarter.

Class Sessions

At the Huntington Avenue campus, lecture periods consist of one hour and forty-minute sessions beginning at 4:10 p.m., 6:10 p.m., and 8:05 p.m. each weekday and at 9:00 a.m. or 10:50 a.m. on Saturdays. At the Suburban Campus and Burlington High School, Burlington, lecture periods will begin at 4:10 p.m., 6:10 p.m., and 8:10 p.m. At the Lincoln College campuses listed above, lecture periods begin at 6:10 or 8:10 p.m. Day sessions at the Suburban Campus, Burlington, begin at 8:00 a.m. Design and laboratory courses are of longer duration and may occupy a full evening. All laboratory courses are conducted on the Huntington Avenue campus.

Course Work

All the usual methods of instruction are employed—lectures, home assignments, class projects, laboratory work, irregularly scheduled quizzes, and formal examinations. In addition, mid-course examinations are scheduled in most courses and a final examination is required at the completion of all courses. Students are responsible for fulfilling all the requirements of a course. In the event of absence, students must make appropriate arrangements for makeup with the instructor. Students must follow the procedures outlined below for makeup of missed mid-term or final examinations.

Student Study Areas

The University Library is well equipped with technical literature. A detailed statement about its facilities and hours appears on page 23.

Attendance

Students absent from regularly scheduled sessions in any subject, for whatever reason, may seriously jeopardize their academic progress and status. Students are expected to be in attendance at all the sessions scheduled in their courses. Excessive absence may be sufficient cause for the Registrar to remove the subject(s) from the student's schedule.

Withdrawal

Simply ceasing to attend classes or notifying the instructor does not constitute official withdrawal from a course. To withdraw officially, the student must notify the Registrar's Office or complete the appropriate withdrawal form.

The Registrar will withdraw a student from a course who:

1. Does not attend one of the first three classes at the beginning of a 12-week quarter;
2. Does not attend one of the first two classes at the beginning of a summer term.

Family Educational Rights and Privacy Act

In accordance with the Family Educational Rights and Privacy Act of 1974, Northeastern University permits its students to inspect their records whenever appropriate and to challenge specific parts of them when they feel it necessary to do so. Specific details of the law as it applies to Northeastern are printed in the *Student Handbook* and are distributed annually at registrations of University College and the graduate schools.

It is the policy of Northeastern University to deal with the student in all academic and administrative matters. If parents require any information regarding the progress of their son or daughter, they may contact the Dean of Students Office.

MAKEUP EXAMINATIONS**Mid-course Examinations**

A student absent from a regularly scheduled mid-course examination or quiz may request permission to take a makeup examination. This is a privilege which may be denied if abused by an excessive number of petitions or for other reasons.

Students applying for makeup examinations must request from the instructor permission to take the mid-term examination or quiz. The instructor will forward the examination to the Lincoln College Office for processing.

Makeup mid-term examinations and quizzes will be given on a Saturday at 9:00 a.m. in a designated room at the Huntington Avenue campus according to the published schedule. Contact the Lincoln College Office, 408 Churchill Hall (Telephone 437-2500).

Any student who does not take the makeup examination as scheduled will forfeit the makeup privilege.

Missed Final Examinations

A student absent from a final examination will receive a grade of "I" (Incomplete) in the course. He or she may petition for a makeup final examination at the Registrar's Office, 120 Hayden Hall.

A student does not automatically have the right to make up a missed final examination. Students must petition for this privilege. If the petition is granted, the student must pay a \$5.00 fee for taking the special final examination. Petitions may be obtained from the Lincoln College Office or in each off-campus Administration Office. Petitions for missed finals must be filed in accordance with the published schedule. Contact the Lincoln College Office, 408 Churchill Hall (Telephone 437-2500).

Students will be notified by mail when and where to take the missed final examination. All examinations will be administered on the Boston campus. Those who do not take makeup final examinations as scheduled forfeit the makeup privilege.

ACADEMIC STANDARDS

The student is required to maintain appropriate levels of academic achievement in terms of grades, quality-point average, and the quantitative credit requirements of his or her program of study to satisfy academic progress criteria and achieve graduation from Lincoln College.

Grading System

The following system of grading is used. The numerical equivalent for each grade is in parentheses.

A	(4.000) —	Outstanding Attainment
A –	(3.667) –	
B +	(3.333) –	
B	(3.000) –	Good Attainment
B –	(2.667) –	
C +	(2.333) –	
C	(2.000) –	Satisfactory Attainment
C –	(1.667) –	
D +	(1.333) –	
D	(1.000) –	Poor Attainment
D –	(0.667) –	
F	(0.000) –	Failure

I	—	—	Incomplete
L	—	—	Audit (No Credit)
S	—	—	Satisfactory achievement in a pass-fail course; counts toward total degree requirements
U	—	—	Unsatisfactory achievement in a pass-fail course
X	—	—	Incomplete in a pass-fail course
*	—	—	Grade not received

A general average of "D" is unacceptable and will not allow a student to continue in Lincoln College or to receive a degree from Northeastern University. The "F" grade is a definite failure. The standard procedure for clearing failures in courses offered in Lincoln College is to repeat the course. In some instances circumstances may warrant amending the standard procedure. These circumstances are described in the *Student Handbook* for day students. An "I" or "X" (incomplete) grade is used for a temporary grade to show that the student has not completed the course requirements.

Pass-Fail Courses

Any student who is not on academic probation and who has completed 40 quarter hours of academic work may register for one pass-fail course and, thereafter, for one course on a pass-fail basis for each 10 quarter hours of successfully completed work. Written permission of the appropriate academic dean must be obtained for each pass-fail course. At no time may a student register for more than one pass-fail course per quarter.

Such courses will be restricted to free electives outside the major field of specialization, so that no part of the specifically prescribed curricula will be affected.

The grades recorded on the basis of the pass-fail system of grading will not figure in the computation of the Q.P.A.

Auditing Policy

Students are permitted to audit courses upon filing the usual registration forms and paying the regular tuition fees. There is no reduction in fees for auditing. An auditor may participate in class discussion, complete papers and projects, and take tests and examinations for informal evaluation if desired. However, regardless of the amount or quality of work completed, **no academic credit will be granted at any time for courses audited.**

Audit Procedure

The student's decision to take a course on an audit basis must be communicated in writing to the Registrar prior to the fourth class meeting of the course. No exception to this procedure can be approved without authorization by the Academic Standing Committee of the College.

Grade Reports

Grades are mailed to the student by the Registrar and will not be given out at the office of either the Registrar or Lincoln College. Under no circumstances will grades be given over the telephone.

Quality-Point Average

The quality points earned by the student in a given course are determined on the basis of the letter grade achieved and the number of credit hours carried by the course. The total quality points earned, divided by the total number of credit hours, constitutes the quality-point average.

1. When the student has more than one grade in the same course, the most recent grade will be used in the calculation of the quality-point average.
2. A grade of "I" will not be considered in the calculation of the final quality-point average.
3. Although advanced standing credits (ASC) allowed for acceptable work completed at other institutions by transfer students count toward completion of the quantitative credit requirements, neither the credits nor the grades earned in such courses are included in quality-point average computations.
4. In programs made up of combined University College and Lincoln College courses, the cumulative quality-point average will include all work in both colleges.

For example, a student who has registered for 13 courses, cleared a failure in one of them, cleared an incomplete in another by repeating the course, and received advanced standing credit (ASC) in another, may calculate the quality-point average as shown on the following page.

Grade Achieved	Numerical Equivalent		Credit Hours		Quality Points
A	4.000	X	4	=	16.000
A –	3.667	X	3	=	11.001
B +	3.333	X	3	=	9.999
B	3.000	X	4	=	12.000
B –	2.667	X	2	=	5.334
C +	2.333	X	2	=	4.666
C	2.000	X	4	=	8.000
C –	1.667	X	3	=	5.001
D +	1.333	X	2	=	2.666
D	1.000	X	3	=	3.000
D –	0.667	X	2	=	1.334
F	0.000	X	2	=	0.000
FB	3.000	X	3	=	9.000
I	—	X	—	=	—
IC	2.000	X	2	=	4.000
ASC	—	X	—	=	—
TOTALS			39		92.001

$$\text{Quality-Point Average} = \frac{\text{Total Quality Points (92.001)}}{\text{Total Credit Hours (39)}} = 2.359$$

The Registrar's Office will not be able to recalculate or confirm the calculations of quality-point averages for individual students. Each student's record will be brought up to date before graduation. In the meantime, borderline cases will be checked by the Lincoln College Academic Standing Committee.

Academic Progress Criteria

It is expected that the student will at all times endeavor to achieve a high record of achievement. The Academic Standing Committee reserves the right to review all students' records and deny readmission to those who fall below a minimum quality level of achievement. This requirement has been established as follows:

In order to be allowed to remain in the College, a student must have achieved a quality-point average of 1.4 at the completion of 24 quarter hours; 1.5 at the end of 48 quarter hours; and 1.6 at the end of 72 quarter hours.

It should be further noted that a student who accumulates the equivalent of six uncleared failures may be considered ineligible to continue the program of study.

Scholastic Probation

The Academic Standing Committee has the authority to dismiss from the College or place on scholastic probation any student whose scholarship is

deficient for the following reasons: low quality-point average or excessive outstanding failures regardless of quality-point average.

A student on scholastic probation should be particularly diligent in current course work and make every effort to clear the academic deficiencies as soon as possible. Students whose academic record does not improve or whose failures are not properly cleared may not be allowed to register for further courses.

A student on scholastic probation who has cleared all or a substantial part of any outstanding failures may petition the Academic Standing Committee for removal from the probation list.

Disciplinary Probation

The Academic Standing Committee has the authority to dismiss from the College or place on disciplinary probation any student whom it may deem unworthy because of conduct or character. The Committee may ask any student to withdraw from the College who is obviously out of sympathy with its aims and ideals.

GRADUATION REQUIREMENTS

To receive the degree of Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology, the student must fulfill the following requirements:

1. Been formally accepted into "degree candidate" status by the Committee on Admissions;
2. Complete all the courses of the particular curriculum, either by attendance at Lincoln College or by receiving Advanced Standing Credit;
3. Complete Associate degree programs in eight years and Bachelor's programs in 12 years from the date of entrance into Lincoln College. Extensions of time may be granted by the Academic Standing Committee;
4. Be in attendance for at least a year preceding the expected graduation date; and complete at least one-fourth of the work in Lincoln College;
5. Achieve a quality-point average of at least 1.800 in courses taken in the College to be awarded the Associate in Engineering or Associate in Science degree. Achieve a quality-point average of at least 2.000 in all courses in their respective major and at least a 1.800 quality-point average overall for the Bachelor or Engineering Technology degree;
6. Pay the graduation fee of \$25.00.

In addition, students:

7. May not earn two Associate degrees or two Bachelor's degrees in the same field of academic specialization;
8. Must complete a minimum of 30 quarter hours of additional credits to be awarded more than one Associate or Bachelor's degree;
9. May not be awarded the Associate and Bachelor's degrees at the same commencement;

10. Must petition for transfer of credits completed at other institutions prior to January 1 of the year in which the degree is to be awarded.

ACADEMIC AND PROFESSIONAL AWARDS

The academic programs offered by Lincoln College and the teaching, counseling, and professional efforts of the faculty and staff are aimed at motivating the student toward the highest possible levels of academic achievement. To encourage scholarly and professional excellence and to recognize quality achievements, the following awards are made at appropriate times during the academic year:

Honor List and Dean's List Scholars

Students maintaining honor grade averages—minimum quality average of 3.000 and no "D" grades—during a quarter while carrying a minimum of 6 quarter hours credit are recognized as Dean's List Scholars. Students desiring certificates attesting to this honor should request them from the Lincoln College Office.

Scholastic Achievement Certificates

Upon graduation with an Associate degree, Scholastic Achievement Certificates will be awarded to those students who have achieved distinctly superior attainment in the academic work as follows:

Scholastic Achievement	3.000-3.499 Q.P.A.
High Scholastic Achievement	3.500-3.749 Q.P.A.
Highest Scholastic Achievement	3.750-4.000 Q.P.A.

In order to be eligible for a Scholastic Achievement Certificate, the student must earn a minimum of 48 quarter hours of credit in Lincoln College.

Graduation with Honor

Upon graduation, honors will be conferred upon students who have achieved distinctly superior academic achievement in a program leading to the Baccalaureate degree as follows:

Honor	3.000-3.499 Q.P.A.
High Honor	3.500-3.749 Q.P.A.
Highest Honor	3.750-4.000 Q.P.A.

In order to be eligible for Honors, the student must earn a minimum of 72 quarter hours credit in Lincoln College and receive a vote of approval from the faculty with responsibility for the program.

University Awards

The University Awards are presented annually to seniors who have achieved high ranking cumulative academic records. Certificates are awarded at the Annual Class Day ceremony.

Technology Awards

The Technology Awards are presented annually to seniors who have demonstrated superior academic and professional capabilities in their special career fields. Appropriate certificates are distributed to outstanding students enrolled in the following program categories:

Civil Engineering Technology
Electrical Engineering Technology
Mechanical Engineering Technology
Computer Technology

Class Marshal Award

The Class Marshal Award is presented annually at the Class Day Banquet for Graduates to the top ranking senior in a baccalaureate program. The award consists of an appropriate certificate and the President's Letter of Commendation.

Sigma Epsilon Rho Awards

Sigma Epsilon Rho, the evening colleges' scholastic honor fraternity, annually awards plaques and scholarships for outstanding scholastic achievement to the highest ranking students in University and Lincoln Colleges at the end of their junior year.

Sigma Epsilon Rho Honor Society Scholarship Award

The Sigma Epsilon Rho Honor Society Scholarship Award, established in 1974 by the membership of the Society, is awarded annually to a student of University and/or Lincoln College. Eligible students must have a cumulative quality point average of 3.0 or better after completing 80 percent or more of their required studies.

Alumni Award for Professional Promise

Established in 1947 by the Northeastern University Alumni Association, the Alumni Award for Professional Promise is presented annually at a final senior class meeting in the spring of the year. The award is made to the senior who has demonstrated unusual professional promise through character traits, scholastic achievement, and work performance.

Leslie B. Cutler Aviation Awards

The Leslie B. Cutler Aviation Awards were established by the members of the Aero Club of New England to honor and give recognition to the late Senator Cutler's service and devotion to the interests of aviation in the Massachusetts General Court, national legislative bodies, and her private life. These scholarship awards are made to students in the Commercial Aeronautical Technology Program who most typify the same interest, devotion, and leadership demonstrated by Senator Cutler during her long and distinguished public career.

Mark Caldwell Whitney Memorial Aviation Scholarship Fund

This Fund was established in 1981 by the family and friends of the late Mark Caldwell Whitney, an outstanding 1973 graduate of the Aeronautical Technology Program. Income from the Fund will be awarded annually to a student with financial need who exemplifies Mr. Whitney's love of flying and commitment to excellence in the aviation field.

financial information

TUITION

Initial Registration Fee

A nonrefundable \$10.00 registration fee, required of all new students, is due and payable upon registration.

Tuition

Tuition for all part-time evening courses offered for 1981–1982 is \$65.00 per quarter hour of credit. Tuition for Day B.E.T. students will be based on the current day school rate. Charges for registration and tuition for special courses are at the rate specified for each course. Students are permitted to audit courses; however, there is no reduction in fees for auditing.

Students are not permitted to attend class sessions or take any examination or test until they have paid their tuition fees or have made satisfactory arrangements for payment.

Students will not be advanced in class standing, nor permitted to reenroll in the University, nor have degrees conferred, until all financial obligations to the University have been met.

No certificate of honorable dismissal will be issued to any student who has not fully met his or her financial obligations to the University.

Noncredit courses are charged at quarter-hour rates equal to those of credit courses meeting on an equivalent contact-hour schedule.

Courses in Other Departments of the University

Students assigned to courses in other departments or colleges of the University are charged the tuition rates and other fees effective in the departments in which they are enrolled.

Aeronautical Technology Tuition (Day Program)

The amount of flight instruction required by each aeronautical technology student is not fixed. Since each student progresses at his or her own pace, exact tuition quotes cannot be made for the complete program. Students will be free to negotiate the flight tuition with the several flight schools approved by the University.

Day Program Tuition Deposit

Applicants accepted for admission to the day program must upon request pay a nonreturnable tuition deposit of \$100 as evidence of their intention to enroll; this will be applied to their first tuition payment.

Tuition for all courses is charged on a quarter basis and is payable in full at the beginning of each quarter. As a convenience without additional charge, and at the student's request, the Bursar's Office will allow payment in two installments.

Deferred-Payment Privilege

Occasionally situations develop, usually beyond the control of the student, which make it difficult to meet payments in the regular manner. Under such circumstances, the student is advised to discuss the problem personally with the Bursar's Office, where a convenient deferred-payment agreement can be worked out. A service fee of \$5.00 is charged for this privilege.

Late Payment Fee

Payments of tuition are due by Saturday of the week in which the bill is dated. If payment, or a deferred-payment agreement, is not arranged by that date, a late fee of \$100 is charged by the Bursar.

Refund of Tuition

The general policy in all schools and colleges of the University with respect to refunds of tuition to students is as follows:

The University provides all instruction on an academic quarter basis for which students pay at the beginning of each quarter. Tuition refunds will be granted through the first four weeks of a quarter only when specified conditions are met. Questions regarding refunds should be discussed with the Bursar.

Tuition refunds will be granted only on the basis of the date appearing on the official withdrawal application when filed with the Registrar in Room 120 Hayden Hall. Nonattendance does not constitute official withdrawal.

Refunds will be granted in accordance with the following schedule:

Official withdrawal filed within:	Percentage of tuition
1st week of quarter	100%
2nd week of quarter	75%
3rd week of quarter	50%
4th week of quarter	25%

Tuition Underwritten by Employers

An increasing number of companies are underwriting part or all of the cost of tuition of students in their employ. In cases in which payment is made directly by the employer to the University, the student should furnish the Bursar's Office a purchase order covering the registration or a statement from an officer of his or her company certifying that the company is underwriting the tuition.

Student Bursar

All inquiries about student accounts should be directed to the Student Account Bursar, 437-2270.

Veterans' Benefits

Veterans' benefits depend on course load and increase sharply when a student's program exceeds eight quarter hours per quarter. Questions and applications should be directed to Room 116 Hayden Hall, Telephone 437-2283.

SPECIAL FEES

International Student Fee

New undergraduate international students are charged a \$200 fee, payable, one time only, upon admission to the University.

Student Center Fee

Students attending the Huntington Avenue campus, Boston, in the evening in a part-time program of study will be assessed a Student Center Fee of 75¢ per quarter.

Health Service Fee

Students attending the Boston, full-time Day cooperative B.E.T. programs are required to pay a Health Service Fee of \$200. The program is available to Aeronautical Technology students on an optional basis.

Missed Final Examination Fee

Students absent from the regularly scheduled final examination at the end of a course may petition for a "special final examination". The fee for each examination requested by the student is \$5.00. The fee must be paid when the petition is filed in the Lincoln College Office.

Proficiency Examination Fee

Applicants for admission may petition to be awarded advanced standing on the basis of achievement demonstrated by a "proficiency examination". The fee for each examination requested by the applicant is \$10.00. The fee must be paid when the petition is filed in the Lincoln College Office.

Graduation Fee

The University graduation fee, charged to candidates for the Associate or Bachelor's degree, is \$25.00, payable on or before May 1 of the year in which the student expects to graduate.

Transcript of Record Fee

Students may request transcripts of their records at the University Registrar's Office. There is no charge for the first transcript. After the initial transcript there is a charge of \$2.00 per copy, payable in advance.

TEXTBOOKS AND SUPPLIES

Students purchase their own textbooks and work materials. The cost varies according to the subject for which the student is enrolled. The average cost for a normal program of four subjects generally ranges from \$30.00 to \$65.00. Textbooks for single courses range from \$4.00 to \$25.00.

Students enrolled in Engineering Graphics should be prepared to spend \$10.00 to \$15.00 for drawing supplies and \$10.00 to \$20.00 for a set of drawing instruments in addition to the textbooks.

LOAN PROGRAMS

Full-time students in Lincoln College who are pursuing the B.E.T. Program should refer to the Undergraduate Catalog for financial aid information.

FINANCIAL AID

The Office of Financial Aid, located in 254 Richards Hall, offers several types of assistance to part-time students. All awards are based on financial need. Aid granted from programs sponsored by the Federal government is dependent upon the amount of funding allocated to Northeastern University.

Basic Educational Opportunity Grants (BEOG)

The Basic Educational Opportunity Grant program is a Federal aid program designed to provide financial assistance to those who need it to attend post-high school educational institutions. Basic Grants are intended to be the "floor" of a financial aid package and may be combined with other forms of aid in order to meet the full costs of education. BEOG is a grant and, unlike a loan, does not have to be repaid. Half-time students taking at least 6 credit hours each quarter may apply. Awards range up to one-half the maximum allowable by law, contingent upon the total cost of education. Applications are available in the Office of Financial Aid, 254 Richards Hall, or by writing to BEOG, Post Office Box 84, Washington, D.C. 20044.

National Direct Student Loan

This program is available to students who are carrying at least one-half the normal academic workload, are accepted as degree candidates, i.e., have 16 credit hours and a matriculation certificate, and who show evidence of financial need.

Direct Loans are available to students who present evidence of needing financial assistance. Undergraduate students may borrow up to a maximum of \$3,000 for the first two years, or a total of \$6,000 for their entire undergraduate education. Students are allowed a total maximum of \$12,000 through their undergraduate and graduate education. Repayment and interest on Direct Loans

are not required until six months after a student graduates or withdraws from the institution. Repayment of principal may be extended over a 10-year period, with the interest rate of 4% per annum. Repayment may be deferred up to a total of three years if the student is pursuing at least a half-time course of study or serving in the Peace Corps, VISTA, or the armed forces.

Community Sources

Students and their families are urged to explore community, industrial, and foundation sources for collegiate financial aid. Parental employers or the appropriate union organization may be a source. In addition, local, civic, political, religious, or educational leaders are often aware of aid sources in the immediate community. Some typical sources may include: P.T.A., Kiwanis, Lions, Elks, Knights of Columbus, Masons, Sons of Italy, Rotary, State Rehabilitation, American Legion, and similar groups or organizations.

University Grants

Each year Northeastern University grants a substantial number of full and partial tuition grants to students who have demonstrated both above-average scholastic achievement and financial need. All applications for aid are automatically considered for all grants administered by the University. It is not necessary for an applicant to specify the grant in which he or she is interested.

Veterans' Benefits

Any veteran covered by the Veterans Readjustment Act of 1966, Public Law 89-358, should report to Room 116 Hayden Hall to fill out the proper enrollment forms. These forms will be made available during registration periods for all students in the Law Enforcement programs at special off-campus locations.

Students needing additional information as to eligibility, allowances, or other details are urged to contact their local office of the Veterans Administration as early as possible.

Guaranteed Student Loan Program

Under this program, students who are matriculated degree candidates, enrolled for at least one-half the normal academic work load, may borrow from a participating bank or other financial institution. Terms and conditions vary from state to state, but a student generally may borrow up to \$2,000 a year (the law allows a maximum of \$2,500 per year) depending on financial need. The Federal government pays the interest while the student is in school if the student is eligible for interest subsidy.

Applications for this loan are available from local banks or the Education Office of your state government. Additional information is available from the Financial Aid Office.

Martin Luther King, Jr. Scholarships

These scholarships were established in 1969 in memory of the late Rev. Martin Luther King, Jr. Awards are made as openings occur to adults from minority groups who would otherwise be unable to continue their education. Stipends will cover tuition expenses not to exceed 6 quarter hours in any academic quarter (excluding the Summer Quarter).

H. Patricia Taylor Scholarship Fund

The H. Patricia Taylor Scholarship Fund was established in 1974 by H. Patricia Taylor, a graduate of University College, and her husband, Harry C. Taylor, a graduate of the School of Business. The Scholarship expresses their appreciation for financial assistance made available to Mrs. Taylor while obtaining her degree, and is an attempt to provide similar funds to assist others in realizing their potential through higher education. The income from the Scholarship Fund will be awarded annually to a student enrolled in University College or Lincoln College who demonstrates financial need and academic stability and who meets certain other conditions of eligibility.

Robert G. Keene Memorial Scholarship Fund

This Fund was established in 1979 in memory of Robert G. Keene, a graduate of Lincoln College, Class of 1972. The endowment funds were provided by the friends and associates of Robert G. Keene and the Polaroid Corporation, where he served as an Engineering Manager. The income from the Fund will be awarded annually to an undergraduate student in any College of the University who demonstrates financial need as well as strong character and initiative. Primary consideration will be given to children of Polaroid employees.

student activities and alumni information

Evening Student Council

The Evening Student Council (E.S.C.) was formed to provide a representative body to promote the welfare of the student body in nonacademic areas and to foster extracurricular activities which will enrich University life. It affords participants opportunities to meet and develop close personal relationships with fellow students and administrative staff.

The Evening Student Council provides students with opportunities to develop leadership skills and gives them a chance to discuss matters of professional interest with experts in their chosen field.

The Council is made up of interested students in University and Lincoln College, representatives of part-time interest groups, and those specially certified by the Council because of their demonstrated interest in the overall adult programs of the University.

The E.S.C., a member of the United States Association of Evening Student Councils, meets evenings on a monthly basis. Students are welcome to visit, observe, and express opinions concerning evening student life.

Social and Professional Clubs

Student activities for part-time students are planned, organized, and operated by the student body with the assistance of the Director of University-Lincoln College Student Activities. The programs are designed to keep pace with the changing needs of adult students and to provide maximum opportunity for student participation. All part-time students in University College and Lincoln College are welcome to participate.

The program is flexible in nature and pioneering in spirit to meet the needs of adult students. The Office of University-Lincoln College Student Activities is particularly interested in developing new clubs which will benefit students professionally and educationally. If students wish to start clubs related to their professions, this office will help them plan and organize on the local and national level. The program is dedicated to assisting the adult student in the development of his or her fullest potential. The University-Lincoln College Student Activities Office is located in 102 Churchill Hall.

Use of Gymnasium Facilities

Specific schedules for use of the pool, weight training room, indoor athletic field and track, gymnasium, and wrestling room are set up each quarter for use by all part-time students. In order to become eligible, students must obtain a temporary gymnasium pass each time they wish to use the Cabot Gymnasium

complex. Passes are available in Cabot, Room 111, Monday through Friday from 4:30 p.m. to 9:30 p.m., and on Saturday and Sunday during all open hours. All students requesting a pass must present their Student Identification Card. Students using the Cabot Gymnasium complex are required to abide by all the rules of the gym and may be asked to complete a Medical Release Form. Revised schedules for holiday periods will be posted.

Alpha Eta Rho

The Nu Epsilon Chapter of this international aviation fraternity is a social organization open to all Aeronautical Technology students. It is organized to actively associate the interested students of aviation with leaders and executives in the industry. This close association, strengthened through the bonds of an international aviation fraternity, establishes opportunities for members in their relation to aviation and inspires interest and cooperation among those in the profession who are also members of Alpha Eta Rho.

Alumni Association

More than 86,000 alumni are members of the all-University Alumni Association, which has as its prime purposes the promotion of the welfare of Northeastern University, the establishment of a mutually beneficial relationship between the University and its alumni, and the perpetuation of fellowship among members of the Association.

The Association headquarters are located in 310 Churchill Hall. The official records and addresses of alumni are maintained at 236 Huntington Avenue.

Activities of the Association, including the Homecoming Day celebration and the annual presentation of Professional Promise Awards to outstanding seniors in each of the colleges, are directed by the Vice President for Alumni Affairs. Alumni officers also attend meetings of undergraduate classes to form a closer relationship between the Association and its future members.

The Alumni Relations Office assists the various class officers in planning class reunions. Each class normally holds a reunion every five years during the month of June. The Vice President for the Alumni Class Council is responsible for coordinating class activities and organizing class functions.

The Vice President for Alumni Clubs works in close association with officers of the more than 50 Regional Alumni Clubs which have been established from coast to coast. All alumni are eligible to become members of these organizations. The alumni clubs meet periodically, often in conjunction with visits from members of the faculty or with athletic events.

For Boston area alumni, monthly luncheon meetings are held in both the downtown and uptown sections of the city.

The Association also sponsors and assists the alumnae organization and the Varsity Club, both of which have their own officers and conduct various programs throughout the year. Through the Varsity Club, the Association presents trophies to the outstanding athlete of the year in each of the six major sports.

One of the most recent developments in alumni activities is the organization of seminars, which are conducted by the Association in cooperation with the University's Center for Continuing Education. The seminars are designed particularly for alumni who have a special interest in current events and the field of adult education.

The Northeastern University Alumni Association is a member of the American Alumni Council, a professional organization composed of representatives of all major colleges and universities in the United States and Canada.

Alumni Relations

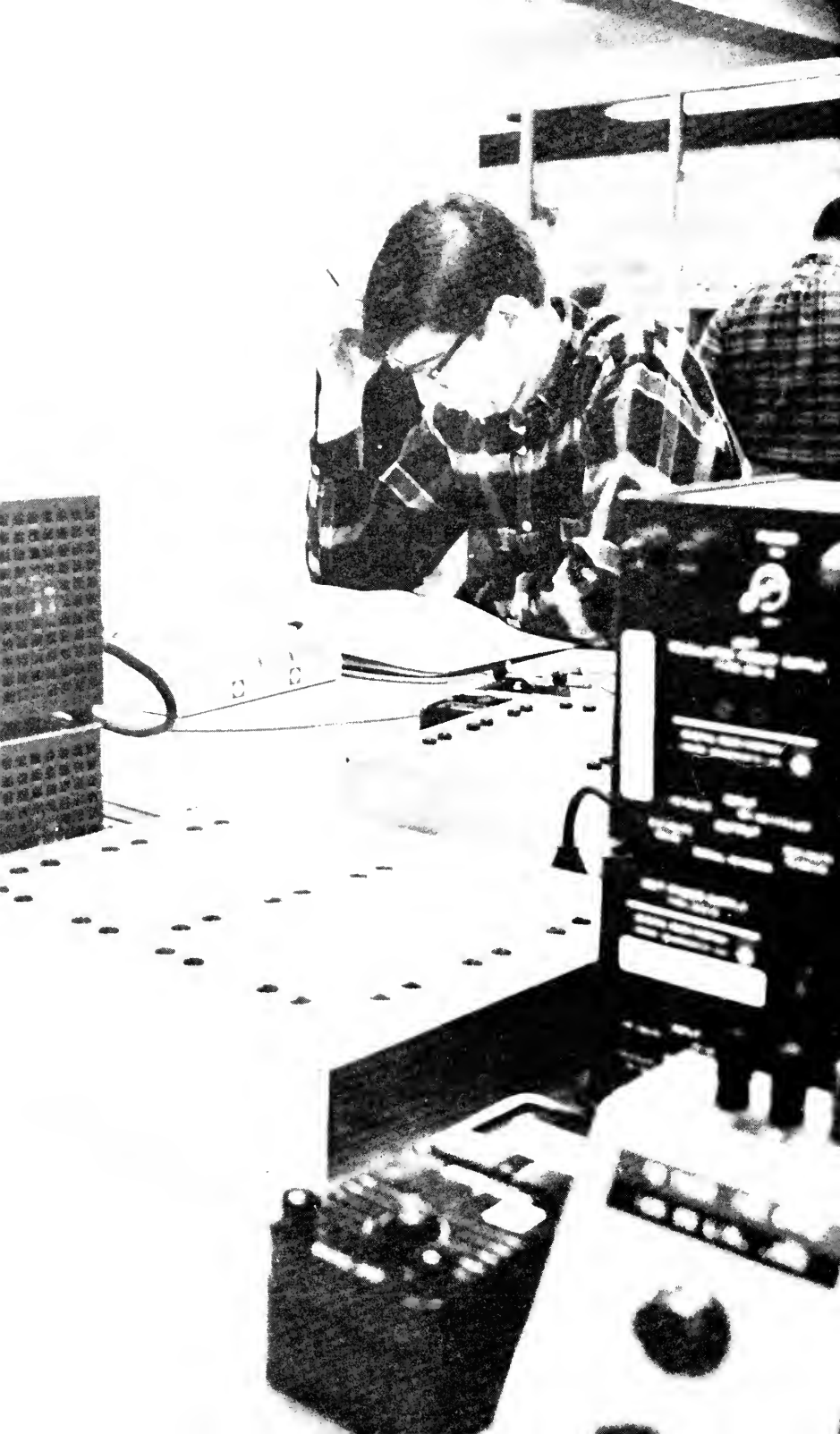
The Alumni Association is providing a uniquely valuable service to both the University and the community by sponsoring admissions conferences for parents of high school students who are interested in attending college. These meetings, held in cooperation with the Northeastern Department of Admissions, have been extremely well attended. Local residents as well as alumni of the University have been invited to these conferences, which help to clarify many of the questions today's parents and young people have concerning application procedures of colleges and universities.

Placement Service

Many requests from employers are received by the College for men and women of potential ability to fill important positions of responsibility. It is the policy of the College to serve the students whenever possible by placing them in those positions which promise attractive opportunities for development and advancement. The College cannot guarantee to place its students, but it does endeavor to keep in close touch with those who desire placement service and to assist them in obtaining satisfactory advancement in position and income. No charge is made for placement service. Those needing this assistance should arrange an appointment with the Director of Placement.

While the College cannot guarantee positions to its graduates, the number of requests usually exceeds the number available in the graduating class of any given year. The policy of the College is to find the best qualified men and women among its graduates for the positions which the College is called upon to fill.

The College, in recommending a graduate for a position, furnishes the prospective employer with the facts as to the graduate's ability, character, attitudes, habits, and other qualifications for the position as revealed by the College records. In the last analysis, however, placement in a position depends largely upon the graduate's ability to sell his or her services to the prospective employer. Most employers prefer to consider two or more candidates for a position and generally ask the College to suggest more than one person. Many manufacturing and commercial firms throughout New England call upon the College to assist them in filling important executive and managerial positions.



academic programs of instruction

SCOPE OF PROGRAMMING

Lincoln College, either by itself or in collaboration with University College, conducts educational programs at the undergraduate level in the following areas of technology:

- Pre-Technology Preparation
- Aeronautical Technology
- Civil Engineering Technology
- Electrical Engineering Technology
- Mechanical Engineering Technology
- Computer Technology

Program Selection

Students should be sure that the program they desire is offered in a suitable time period. Most programs are offered in the evening on a part-time basis. However, Aeronautical Technology is offered only on a full-time day basis.

In the fields of Electrical Engineering Technology and Mechanical Engineering Technology, full-time day cooperative programs were established in the fall of 1971. Students may enter as freshmen or transfer with advanced standing by applying to the Office of Admissions, Northeastern University, 150 Richards Hall.

Degrees and Certificates

Lincoln College conducts education programs on the undergraduate level in various technological areas leading to the following degrees and certificates:

1. Associate in Science degree (A.S.) requiring 96 to 105 quarter hours of credit;
2. Associate in Engineering degree (A.E.) requiring 96 to 103 quarter hours of credit;
3. Bachelor of Engineering Technology degree (B.E.T.) requiring 180 to 183 quarter hours of credit.

Most courses are available for special students.

Opportunities for Associate Degree Graduates

Graduates of the Engineering or Science Technology Programs in Lincoln College, or other similar colleges and institutions, who have earned the Associate in Engineering or the Associate in Science degree, may transfer ap-

plicable credits toward the degree requirements in the baccalaureate programs in Engineering Technology, Medical Technology, or Industrial Technology.

Those who have maintained a quality-point average of 2.500 or higher in the Associate degree programs may apply for transfer to either of the following College of Engineering curricula: (1) day college cooperative education programs in Civil, Mechanical, Electrical, or Industrial Engineering with credit for up to two years of the five-year program; or (2) the part-time evening programs in Civil, Electrical, or Mechanical Engineering with credit for the first three years of the eight-year programs. Fractional credit may be awarded to students with a quality-point average slightly lower than 2.500.

PRE-TECHNOLOGY PREPARATION

(Noncredit)

Beginning students who have been away from formal study for some time are frequently concerned about their study habits and their verbal, mathematical, and scientific backgrounds. Applicants who anticipate some problems should give serious consideration to enrolling in the noncredit introductory courses, the Reading Improvement Program, or doing review work through programmed instruction at the Learning Center.

Introductory Courses

These courses offer the student the opportunity to develop background for basic courses in the degree programs and thus increase the probability of successful achievement in advanced technology courses.

Introductory Mathematics I and II

A two-quarter review of high school algebra and some plane geometry designed to prepare students for the course 10.607 College Algebra and Trigonometry I. These courses are required of students who do not demonstrate sufficient algebra proficiency on the Mathematics Placement Test. (See course descriptions for 10.681 and 10.682, page 136.)

Introductory Physics I and II

A two-quarter relatively nonmathematical introduction to the concepts of physics designed to allow students to prepare themselves for the courses 11.617 Physics I or 11.604 General Physics I. (See course descriptions for 11.681 and 11.682, page 139).

Basic Mathematics I and II

A two-quarter review of basic algebra offers students the opportunity to prepare themselves for the course 10.627 Mathematics I. These courses are required of students who do not demonstrate sufficient proficiency in algebra on

the Mathematics Placement Test. (See course descriptions for 10.671 and 10.672, page 136.)

English for International Students I, II, III

A three-quarter, noncredit sequence for foreign-speaking students covering introduction to English grammar, with emphasis on listening, speaking, and writing; selected readings and exercises to strengthen vocabulary and pronunciation; preparation of written and oral reports, business and social correspondence; and advanced work in written and spoken English preparatory to entering 30.305 English I.

Reading Improvement

The ability to read well is one of the most important basic tools for the successful completion of a college program. The University's Center for Reading Improvement gives the student an opportunity to develop good reading habits in preparation for the intensive reading assignments of college-level courses. The following core skills are covered: previewing, locating main ideas and related details, using guide words and phrases, identifying structural patterns, outlining and summarizing, note-taking, vocabulary building, skimming and scanning, speed-reading, and critical reading. Further information may be obtained at the Center for Reading Improvement.

Programmed Study

Students may enroll in noncredit, self-study courses to better prepare themselves for college academic work and strengthen their high school background at the University's Learning Resources Center.

Courses which may be useful to students in the Lincoln College programs in technology are: slide rule, trigonometry, effective listening, spelling, algebra, study skills, calculus, and English.

University Learning Resources Center hours:

Monday, Tuesday, Wednesday, Thursday—8:00 a.m.-8:00 p.m.

(Thursday—closed 12:50 p.m.-1:50 p.m.)

Friday—8:00 a.m.-7:00 p.m.

Saturday, Sunday—1:00 p.m.-5:00 p.m.

AERONAUTICAL TECHNOLOGY PROGRAM

The Aeronautical Technology Program offered by Lincoln College through its Federal Aviation Administration Approved Pilot Ground School offers exposure to the scientific, technological, and business backgrounds required by the modern commercial pilot or entrepreneur in today's aviation and aerospace world as it operates within the framework of the total ship-rail-motor-aircraft transportation industry.

The tremendous expansion of aviation as an increasingly important sector of the nation's industrial economy has accelerated the demand for appropriately

trained and educated personnel for careers related to the flight, instructional, regulatory, management, and technical aspects of the aviation industry.

Flight opportunities range from pilot or co-pilot in the single- or multi-engine air-taxi and cargo services of the feeder airlines or private company; to flight engineer, first officer, or captain in the high speed, multi-jet-engined services of the national and international systems of the major airlines.

The education-training-regulation sector of the aviation industry provides additional career opportunities as flight, ground, or simulator instructors or as flight examiners, training or safety directors, and supervisors in the licensing and regulatory agencies of local, state, or Federal government.

Persons knowledgeable in the technology and regulations of aviation, who are also skillful in dealing with people, may pursue challenging and rewarding careers in aviation sales, airport operations, aviation business management, or related areas.

The Aeronautical Technology related program, presently offered by Lincoln College, is a two-year full-time day program which leads to an Associate in Science degree.

This program is conducted at the Suburban Campus in Burlington, Massachusetts, and local air fields. Aeronautical students at Northeastern University need their own transportation, since there are no dormitories on this campus.

Aeronautical Technology**Major Code 096***Leading to the Degree of Associate in Science*
(Day Program—2 Years)

The curriculum of the Aeronautical Technology program offers students the opportunity to prepare themselves in the shortest reasonable time to assimilate the required amount of related academic instruction and accumulated flight time for certification with the Private and Commercial Instrument Ratings by the Federal Aviation Administration.

Prerequisites: An applicant for admission to the Aeronautical program should have completed a minimum of algebra I and II and geometry. The student must have a high school diploma or its equivalent. The flight student will be required to obtain the F.A.A. Class I or II medical certificate. All candidates for admission must have an interview with the Aeronautical program counselor.

First Year

Course Number			Q.H.
10.607	10.608	College Algebra & Trigonometry I, II	8
	10.620*	Calculus I	4
11.617	11.618	11.619	Physics I, II, III
30.305	30.306		English I, II
		93.401	Technical Communications
96.404			Fundamentals of Aeronautics
	96.437		Advanced Aeronautics
		96.444	Meteorology & Climatology

*Optional

Second Year

96.308			Aircraft Power Plants & Systems	4
	96.324	96.325	Introductory Avionics, Avionics	8
96.418			Intermodal Transportation	4
	48.314		Air Transportation	3
		96.420	Airline Traffic & Sales	4
96.417			General Aviation Operations	4
	41.301	41.302	Accounting & Principles I, II	6
96.438			Instrument Procedures	4
	96.410		Aviation History I	4
		(. .)	Aeronautical Elective	4

Professional Pilot Program (Flight)

96.334			Private Flight Lab.	4
	96.439		Advanced Flight Lab.	4
		96.339	Instrument Flight Lab.	4

Total A.S. Degree 103

With the approval of their adviser, students following the professional pilot track will satisfy the program flight training requirements at Northeastern University recommended

70 / ACADEMIC PROGRAMS OF INSTRUCTION

flight schools. These students will be required to make individual arrangements for their flight training and will be awarded credit based on the successful completion of the rating being sought.

Second Year (Non-Flight Option)

Students electing the Non-Flight Option will replace the commercial flight courses with a sequence of air transportation, law enforcement, engineering, or airport management courses. These courses are listed under the description of courses at the end of the catalog.

Students having definite plans to enter other upperclass programs following the completion of the Associate degree should consult their adviser regarding entrance requirements prior to registering for second-year courses.

Students completing the Associate and Bachelor's programs may acquire the scientific, technological, and business background for employment in a variety of positions, including: Flight Crew Officers, Airport Management, Fixed Base Operations, Air Transportation, Aviation Sales, F.A.A. positions, and others.

Notwithstanding any of the other Aeronautical program requirements, each student must satisfactorily complete 96 quarter hours of course work to be eligible for the Associate degree.

Certificate of Advanced Study in Aeronautical Technology

The Certificate of Advanced Study in Aeronautical Technology will be awarded to students who satisfactorily complete 48 quarter hours of course work beyond the Associate degree.

Course programs will be arranged to enhance the student's individual career objectives and will consist of advanced aeronautical courses, engineering technology, or science courses.

Prerequisite: Associate degree in Aeronautical Engineering or equivalent.

CIVIL ENGINEERING TECHNOLOGY PROGRAMS

Civil Engineering deals with the planning and construction of all kinds of relatively permanent structures and public works. Its major functions are: the preparation of surveys (topographical, geological, traffic, utility, etc.); the design of structures (buildings, bridges, dams, harbor facilities, etc.); the planning of municipal systems (water, sanitary, gas, flood control, air pollution control, etc.); and the development of transportation facilities (highway, railway, waterway, airway, etc.).

In performing these functions, the civil engineer usually works in close association with professionals in the field and may develop technologically to function independently and in positions of managerial responsibility.

Employment opportunities for Civil Engineering Technology program graduates are with town, city, state, or Federal public works departments and agencies; private consulting, engineering, architectural, and construction organizations; and with railroads and the military. Job opportunities will also depend upon the economy and the abilities of the individual.

The Civil Engineering Technology program and related programs offered by Lincoln College are:

Associate in Engineering Degree

Architectural Engineering Technology	page 72
Environmental Engineering Technology	page 73
Structural Engineering Technology	page 74
Surveying and Highway Engineering Technology	page 75

Bachelor of Engineering Technology Degree

Civil Engineering Technology	page 77
Mechanical-Structural Engineering Technology	page 102

Architectural Engineering Technology**Major Code 025***Leading to the Degree of Associate in Engineering*

The program in Architectural Engineering Technology offers students the opportunity to prepare to assume responsibilities in the planning, design, and construction of buildings. Employment opportunities are with architectural groups, consulting engineering firms, and government agencies. Job opportunities will also depend upon the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.	
10.607		College Algebra	4	
	10.608	Introduction to Calculus	4	
		10.620	Calculus I	4
09.670	09.671	Engineering Graphics I, II	8	
		06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
10.621			Calculus A	4
	11.673	11.674	Physics Laboratory I, II	4

Third Year

12.444			General Chemistry I	3
	30.306		English II	
	or			3
	30.411		Technical Writing II	
		01.621	Introduction to Structural Design	4
02.611			Mechanics A	4
	02.614	02.615	Stress Analysis A, B	8
39.301	39.302		Economic Principles and Problems I, II	6

Fourth Year

01.624			Structural Analysis I	4
	01.691	01.692	Architectural Design I, II*	8
01.690			Technology of Modern Architecture	4
	01.671		Concrete Design I	4
		01.631	Steel Design I	4
				<hr/>
Total A.E. Degree				102

Note: Associate degree graduates may transfer applicable credits toward the requirements in other Lincoln College programs leading to the Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology degree.

*27.541, 27.542, 27.543 Drawing I, II, III (*Prereq. none*)—a basic drawing course in developing pencil, pen, and wash techniques; and the study of basic drawing problems using a variety of media—may be used to supplement this program.

Environmental Engineering Technology**Major Code 011***Leading to the Degree of Associate in Engineering*

The program in Environmental Engineering Technology offers the student the opportunity to prepare to assume responsibilities related to the design, construction, operation, and supervision of municipal plants and systems concerned with the storage and distribution of water, and also the disposal of sewage and waste in urban areas with strong considerations regarding contamination and pollution. Employment opportunities are with town, city, and state public works departments, private engineering consultants, architects, contractors, and many other engineering organizations. Job opportunities will also depend upon the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.	
10.607		College Algebra	4	
	10.608	Introduction to Calculus	4	
		10.620	Calculus I	4
09.670	09.671	Engineering Graphics I, II	8	
		06.600	Computer Programming for Eng. Tech.	4

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Second Year

11.617	11.618	11.619	Physics I, II, III	12
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
10.621			Calculus A	4
	11.673	11.674	Physics Laboratory I, II	4

Third Year

12.444			General Chemistry I	3
	30.306		English II	
	or			3
	30.411		Technical Writing II	
		01.641	Fluid Mechanics	4
02.611			Mechanics A	4
	02.614	02.615	Stress Analysis A, B	8
39.301	39.302		Economic Principles and Problems I, II	6

Fourth Year

01.624			Structural Analysis I	4
	01.650		Environmental Engineering I	4
		01.693	Construction Administration	4
01.661			Materials and Soil Mechanics	4
	01.671		Concrete Design I	4
		01.651	Environmental Engineering II	4

Total A.E. Degree 102

Note: Associate degree graduates may transfer applicable credits toward the requirements in other Lincoln College programs leading to the Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology degree.

Structural Engineering Technology

Major Code 012

Leading to the Degree of Associate in Engineering

The program in Structural Engineering Technology offers the student the opportunity to prepare to assume responsibilities related to the planning, design, and supervision of the construction of buildings, bridges, foundations; flood-control projects, and all fixed structures. Employment opportunities are with consulting engineering firms, architectural groups, contractors, railroads, government agencies, the military, and other design-related companies. Job opportunities will also depend upon the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number				Q.H.
10.607			College Algebra	4
	10.608		Introduction to Calculus	4
		10.620	Calculus I	4
09.670	09.671		Engineering Graphics I, II	8
		06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
10.621			Calculus A	4
	11.673	11.674	Physics Laboratory I, II	4

Third Year

12.444			General Chemistry I	3
	30.306		English II	
	or			3
	30.411		Technical Writing II	
		01.621	Introduction to Structural Design	4
02.611			Mechanics A	4
	02.614	02.615	Stress Analysis A, B	8
39.301	39.302		Economic Principles and Problems I, II	6

Fourth Year

01.624	01.625		Structural Analysis I, II	8
		01.693	Construction Administration	4
01.661			Materials and Soil Mechanics	4
	01.671		Concrete Design I	4
		01.631	Steel Design I	4
Total A.E. Degree				102

Note: Associate degree graduates may transfer applicable credits toward the requirements in other Lincoln College programs leading to the Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology degree.

Surveying and Highway Engineering Technology**Major Code 013***Leading to the Degree of Associate in Engineering*

The program in Surveying and Highway Engineering Technology offers the student the opportunity to prepare to assume responsibilities related to the preparation and calculation of preliminary and legal surveys required for both small projects, such as subdivision work, individual lot layouts, and highway layouts, as well as more complex projects relating to sewer systems, pipelines, power transmission lines, dams, reservoirs, and aqueducts. Employment opportunities are with independent surveying companies, civil engineering

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companies, highway, transit, and railroad planning groups, as well as cartographers, construction companies, and contractors. Job opportunities will also depend on the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number				Q.H.
10.607			College Algebra	4
	10.608		Introduction to Calculus	4
		10.620	Calculus I	4
09.670	09.671		Engineering Graphics I, II	8
		06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
10.621			Calculus A	4
	11.673	11.674	Physics Laboratory I, II	4

Third Year

12.444			General Chemistry I	3
	30.306		English II	
	or			3
	30.411		Technical Writing II	
		01.641	Fluid Mechanics	4
02.611			Mechanics A	4
	02.614	02.615	Stress Analysis A, B	8
39.301	39.302		Economic Principles and Problems I, II	6

Fourth Year

01.601			Plane Surveying	4
	01.602		Geodetic Surveying	4
		01.611	Highway Engineering	4
01.607			Legal Aspects of Surveying	4
	01.616		Land Use Planning	4
		01.603	Route Surveying	4

Total A.E. Degree	102
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Note: Associate degree graduates may transfer applicable credits toward the requirements in other Lincoln College programs leading to the Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology degree.

Civil Engineering Technology**Major Code 014**

(Accredited by Engineers' Council for Professional Development)
Leading to the Degree of Bachelor of Engineering Technology

The program in Civil Engineering Technology offers the student the opportunity to prepare to assume broad responsibilities related to surveys required to develop initial design criteria and specifications, and to become involved in the planning, design, and construction of all kinds of relatively permanent structures, municipal plants and systems, or transportation systems and facilities. Employment opportunities are in private consulting firms, construction companies, and public works agencies. Work involving surveying, design, and supervision is open to graduates. Job opportunities will also depend on the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.	
10.607		College Algebra	4	
	10.608	Introduction to Calculus	4	
		10.620	Calculus I	4
09.670	09.671	Engineering Graphics I, II	8	
		06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
10.621			Calculus A	4
	11.673	11.674	Physics Laboratory I, II	4

Third Year

12.444			General Chemistry I	3
	30.306		English II	
	or			3
	30.411		Technical Writing II	
		02.615	Stress Analysis B	4
02.611			Mechanics A	4
	02.614		Stress Analysis A	4
		01.641	Fluid Mechanics	4
39.301	39.302		Economic Principles and Problems I, II	6

Fourth Year

01.601		Plane Surveying	4
	01.602	Geodetic Surveying	4
		01.603	Route Surveying
()		Arts and Sciences Elective	3
01.624	01.625	Structural Analysis I, II	8
		01.621	Introduction to Design

Fifth Year

01.661		Materials and Soil Mechanics	4	
	01.650	Environmental Engineering I	4	
		01.672	Concrete Design II	4
()		Arts and Sciences Elective	3	
()		Arts and Sciences Elective	3	
	01.671	Concrete Design I	4	
		01.631	Steel Design I	4

Sixth Year

01.632			Steel Design II	4
	01.662		Soil Mechanics and Soil Foundations	4
		01.611	Highway Engineering	4
()	()	()	Arts and Sciences Electives	9
()	()	()	*Lab. Electives	6

Seventh Year

()	()	()	Technical Electives A, B, C	12
()	()	()	Technical Electives A, B, C	12
Total B.E.T. Degree				182

Suggested Technical Electives A

01.607	Legal Aspects of Surveying	4
01.690	Technology of Modern Architecture	4
01.694	Civil Engineering Computer Application	4

Suggested Technical Electives B

01.642	Hydraulics	4
01.616	Land Use Planning	4
01.691	Architectural Design I	4

Suggested Technical Electives C

01.651	Environmental Engineering II	4
01.693	Construction Administration	4
01.692	Architectural Design II	4

*Before registering for any electives, the student should submit a proposed program of elective courses—preferably representing a minor field of concentration consistent with his or her personal career objectives—for approval by the Academic Standing Committee.

Suggested Laboratory Electives

01.310 (Summers only)	Surveying Lab.	2
01.314 01.315	Surveying Practice I, II	4
01.380	Environmental Lab.	2
02.364	Materials and Soil Mechanics Lab.	2
02.673	Measurement and Analysis Lab.	2
02.674	Mechanical Technology Lab.	2

Elective courses for which proper preparation exists may be chosen from inside or outside the Civil Engineering discipline.

Transfer students may petition for elective credits for courses that are suitable to the curriculum.

Graduates of the Bachelor of Engineering Technology programs desiring to pursue programs leading to the Bachelor of Science in Engineering degree at Northeastern University may apply through the Admissions Office (150 RI). Programs in Electrical, Civil, and Mechanical Engineering are available on a part-time as well as a regular cooperative program. Industrial and Chemical Engineering programs are available only during the regular day programs.

Candidates must have at least a 2.75 cumulative average and complete a course program prescribed by the major department and the Dean's Office.

ELECTRICAL ENGINEERING TECHNOLOGY PROGRAMS

Electrical Engineering deals with the design and operation of equipment and systems related to power, communications, data processing, and electrical control. Its major functions are: 1) the generation, transmission, and distribution of electrical energy for light and power purposes; 2) the development and production of equipment for telephone, radio, television, radar, and communication; 3) the design and construction of data processing systems and analog or digital computers; and 4) the application of electrical and electronic devices in the control of processes and manufacture.

Employment opportunities for the Electrical Engineering Technology graduate are in public and private research laboratories, engineering consulting groups dealing with industrial and plant applications, design organizations dealing with operation and manufacture, sales engineering, and the electric utility industry. Job opportunities will depend on the economy and the individual's abilities.

The Electrical Engineering Technology program and related programs offered by Lincoln College are:

Associate in Engineering Degree

Electrical Engineering Technology page 81

Bachelor of Engineering Technology Degree

Electrical Engineering Technology page 83
(Accredited by Engineers' Council for Professional Development)

The program in Electrical Engineering Technology leading to the Bachelor of Engineering Technology is also offered as a day cooperative program. A specimen curriculum is shown on page 86. For further information please call (617) 437-2200, or write:

Dean of Admissions
Northeastern University
360 Huntington Avenue
Boston, Massachusetts 02115

Electrical Engineering Technology**Major Code 033***Leading to the Degree of Associate in Engineering*

The program in Electrical Engineering Technology offers the student the opportunity to prepare to assume responsibilities related to the design, development, and operation of communications, data processing, and electronic control equipment for applications in computers, military and space explorations, and in automated industrial production equipment. Employment opportunities are in communications equipment, electrical manufacturing, data processing and control, equipment organizations, as well as other engineering-oriented companies. Job opportunities will also depend on the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

First Year

Course Number			Q.H.	
10.607		College Algebra	4	
	10.608	Introduction to Calculus	4	
		10.620	Calculus I	4
09.670		09.672	Eng. Graphics I, Elect. Eng. Graphics	8
	06.600		Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
	11.673	11.674	Physics Laboratory I, II	4
10.621			Calculus A	4
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	

Third Year

10.622	*10.623		Calculus B, C	8
		02.619	Mechanics	4
03.651	03.652		Circuits Analysis I, II	8
		30.306	English II	
		or		3
		30.411	Technical Writing II	
03.624		03.625	Circuits Laboratory I, II	4

Fourth Year

03.611	03.612	03.613	Electronics I, II, III	12
**03.653	†03.654		Circuits Analysis III, IV	8

*Arts and Sciences elective may substitute for 10.623.

**03.614 may substitute for 03.653.

†Technical elective may substitute for 03.654.

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03.610	Electrical Measurements	4
03.623	Electronics Laboratory	2
Total A.E. Degree		<hr/> 103

Note: Associate degree graduates may transfer applicable credits toward the requirements in other Lincoln College programs leading to the Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology degree.

Electrical Engineering Technology**Major Code 035**

(Accredited by Engineers' Council for Professional Development)

Leading to the Degree of Bachelor of Engineering Technology

The program in Electrical Engineering Technology offers the student the opportunity to prepare to assume broad responsibilities related to the design, development, operation, installation, and production of a wide variety of electrical and electronic equipment concerned with the generation and utilization of electric energy, communications, data processing, and industrial control. Employment opportunities are in public and private research laboratories, engineering consulting firms dealing with industrial and plant applications, electric utilities, electrical and electronic organizations concerned with operation, manufacture, installation, and sales. Job opportunities will also depend on the economy and the student's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.
10.607		College Algebra	4
	10.608	Introduction to Calculus	4
		10.620 Calculus I	4
09.670	09.672	Eng. Graphics I, Elect. Eng. Graphics	8
	06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
	11.673	11.674	Physics Laboratory I, II	4
10.621			Calculus A	4
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	

Third Year

10.622	10.623		Calculus B, C	8
		02.619	Mechanics	4
03.651	03.652		Circuits Analysis I, II	8
		30.306	English II	
		or		3
		30.411	Technical Writing	
03.624		03.625	Circuits Laboratory I, II	4

Fourth Year

03.611	03.612	03.613	Electronics I, II, III	12
03.653	03.654		Circuits Analysis III, IV	8
		03.610	Electrical Measurements	4
		03.623	Electronics Laboratory	2

Fifth Year

03.614			Pulse & Digital I	4
	03.()		Technical Elective	4
		03.630	Energy Conversion	4
()	()	()	Arts and Sciences Electives	9
03.627	03.628		Advanced Electronics Labs. I, II	4

Sixth Year

03.670	03.671		Digital Computers I, II	8
		03.637	Distributed Systems	4
()	()	()	Arts and Sciences Electives	9
		03.()	Technical Elective	4
	03.629		Advanced Electronics Lab. II	2

Seventh Year

03.()	03.()		Technical Electives	8
	03.677	03.678	Control Engineering I, II	8
()	()	()	Arts and Sciences Electives	9

Total B.E.T. Degree 180

Suggested Technical Electives

03.305			Circuit Theory V	2
03.330			Microwave Measurements	2
03.381	03.382	03.383	Linear Active Circuit Design I, II, III	6
03.396			Basic Optics for Instrumentation	2
03.397	03.398		Optical Instrumentation I, II	4
03.531	03.532	03.533	Digital Signal Processing	6
03.615			Pulse & Digital II	4
03.617	03.618	03.619	Principles of Communication Systems I, II, III	12
03.662	03.663	03.664	Basic Power Systems I, II, III	12
04.381	04.382	04.383	Nuclear Technology I, II, III	6
05.660			Engineering Economy I	4
05.590	05.591		Engineering Probability & Statistics I, II	4
06.601			Fortran Engineering Computation	4
06.670			Introduction to CPU Hardware	4
06.671			CPU Hardware Architecture	4
11.624			Introductory Survey of Lasers	2

Electrical Engineering Technology courses of an elective nature may be chosen from the above list of courses.

Elective courses for which proper preparation exists may be chosen from inside or outside the Electrical Engineering discipline.

Graduates of the Bachelor of Engineering Technology program desiring to pursue programs leading to the Bachelor of Science in Engineering degree at Northeastern University may apply through the Admissions Office (150 RI). Programs in Electrical, Civil, and Mechanical Engineering are available on a part-time as well as a regular cooperative program. Industrial and Chemical Engineering programs are available only during the regular day programs.

Candidates must have at least a 2.75 cumulative average and complete a course program prescribed by the major department and the Dean's Office.

*Before registering for any electives, the student should submit a proposed program of elective courses—preferably representing a minor field of concentration consistent with his or her personal career objectives—for approval by the Academic Standing Committee.

03.341, 03.342, 03.343 Power & Control Labs. I, II, III may be substituted for 03.627, 03.628, 03.629 Advanced Electronics Labs. I, II, III.

Electrical Engineering Technology

(Day Cooperative Curriculum)

(Accredited by Engineers' Council for Professional Development)

*Leading to the Degree of Bachelor of Engineering Technology***First Year**

Course Number			Q.H.	
10.407	10.408	College Algebra & Trigonometry I, II	8	
	10.420	Calculus I	4	
11.417	11.418	11.419	Physics I, II, III	12
30.113		Freshman Writing	4	
	30.114	Introduction to Literature	4	
	30.206	The Literature of Engineering	4	
09.470	09.471	Engineering Graphics I, II	8	
	11.473	11.474	Physics Laboratory I, II	4
	06.400	Computer Programming for Eng. Tech.	4	

Second Year

10.421	10.422		Calculus A, B	8
03.451	03.452		Circuit Analysis I, II	8
39.115			Principles of Economics	4
	02.419		Mechanics	4
()	()		Social Science/Humanities Electives	8
	03.424		Circuits Laboratory I	2

Third Year

03.453	03.454		Circuits Analysis III, IV	8
03.411	03.412		Electronics I, II	8
03.460			Engineering Analysis I	4
	03.410		Electrical Measurements	4
03.430			Energy Conversion	4
03.425	03.423		Circuits Lab. II, Electronics Lab.	4

Fourth Year

03.413			Electronics III	4
	03.414		Pulse & Digital I	4
03.427	03.428		Advanced Electronics Lab. I, II	4
03.()	03.()		Technical Electives	8
()	()		Social Science/Humanities Electives	8
	03.437		Distributed Systems	4

Fifth Year

03.477	03.478		Control Engineering I, II	8
03.470	03.471		Digital Computers I, II	8
03.()	03.()		Technical Electives	8
03.429			Advanced Electronics Lab. III	2
	()		Social Science/Humanities Elective	4

 Total B.E.T. degree 180

***Note:** Students desiring to terminate their program at the end of Quarter 7 may petition to be awarded the Associate in Engineering degree.

Suggested Technical Electives

02.421	02.422		Thermodynamics A, B	8
02.431	02.432		Materials A, B	8
03.415			Pulse & Digital II	4
03.417	03.418	03.419	Principles of Communication Systems I, II, III	12
03.462	03.463	03.464	Basic Power Systems I, II, III	12
03.490			Optical Measurements	4
04.481			Nuclear Technology	4

Graduates of the day Bachelor of Engineering Technology program who have maintained a superior level of achievement and who wish to continue their academic studies may be qualified to enter the part-time or full-time program leading to the Bachelor of Science in Engineering. For further information, contact the Lincoln College Office at 408 Churchill Hall, telephone 437-2500.

MECHANICAL ENGINEERING TECHNOLOGY PROGRAMS

Mechanical Engineering deals with the harnessing of power resources by means of machinery to perform useful work. In contrast to civil engineering, which deals primarily with static forces and structures, mechanical engineering is more concerned with the motion and kinetics of devices which are activated by hydraulic, electrical, mechanical, or thermodynamic forces. Major functions of the mechanical engineer are: 1) design and installation of all kinds of machinery, from pocket watches to the largest of steel boring mills; 2) development and production of engines and transportation equipment (automobile, aircraft, ship, railway, etc.); 3) construction and operation of furnaces, boilers, and heating and air-conditioning equipment for the control of atmospheric and environmental conditions.

Employment opportunities for Mechanical Engineering Technology graduates are in the areas of 1) research, design, or development; 2) production, operation, testing, or control; 3) installation, maintenance, and sales. In performing these functions, graduates will work in close association with professionals in the field and may develop technologically so as to function independently and in positions of managerial responsibility. Job opportunities will also depend on the economy and the individual's abilities.

The Mechanical Engineering Technology program and related programs offered by Lincoln College are:

Associate in Engineering Degree

Mechanical Engineering Technology	page 89
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Bachelor of Engineering Technology Degree

Mechanical Engineering Technology (Accredited by Engineers' Council for Professional Development)	page 91
Mechanical—Structural Engineering Technology	page 102
(Accredited by Engineers' Council for Professional Development)	

The program in Mechanical Engineering Technology leading to the Bachelor of Engineering Technology is also offered as a day cooperative program. A specimen curriculum is shown on page 94. For further information please call (617) 437-2200, or write:

Dean of Admissions
Northeastern University
360 Huntington Avenue
Boston, Massachusetts 02115

Mechanical Engineering Technology**Major Code 021***Leading to the Degree of Associate in Engineering*

The program in Mechanical Engineering Technology offers the student the opportunity to prepare to assume responsibilities related to the design, production, and installation of mechanical tools, machinery, engines, and transportation equipment in which there is an intermingling of mechanical and hydraulic forces. Because of the increased mechanization of all industry, varied employment opportunities are available in private engineering consultant groups, in light and heavy industries, and in almost all engineering design organizations. Job opportunities will also depend on the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.
10.607		College Algebra	4
	10.608	Introduction to Calculus	4
		10.620 Calculus I	4
09.670	09.671	Engineering Graphics I, II	8
	06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
10.621			Calculus A	4
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
	11.673	11.674	Physics Laboratory I, II	4

Third Year

10.622			Calculus B	4
	09.664		Design Graphics	4
		02.631	Materials A	4
02.611	02.612		Mechanics A, B	8
		02.614	Stress Analysis A	4

Fourth Year

02.615			Stress Analysis B	4
	02.621		Thermodynamics A	4
		02.643	Fluid Mechanics A	4
02.673			Measurement & Analysis Lab.	2
	02.674	02.675	Technology Laboratory A, B	4
()			Arts and Sciences Elective	3

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30.306	English II	
or		3
30.411	Technical Writing II	
39.301	Economic Principles and Problems I	3
Total A.E. Degree		<hr/> 101

Mechanical Engineering Technology**Major Code 023**

(Accredited by Engineers' Council for Professional Development)

Leading to the Degree of Bachelor of Engineering Technology

The program in Mechanical Engineering Technology offers the student the opportunity to prepare to assume broad responsibilities related to the design, development, production, operation, and installation of all kinds of machinery, engines, and transportation equipment, as well as boilers, furnaces, and heating or air-conditioning equipment which involve interactions of mechanical, hydraulic, and thermodynamic forces. Employment opportunities are in industry producing mechanized and automated equipment, in design and engineering organizations, and in companies dealing primarily with manufacture and production. Job opportunities will also depend on the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements in Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.
10.607			
		College Algebra	4
	10.608	Introduction to Calculus	4
		10.620 Calculus I	4
09.670	09.671	Engineering Graphics I, II	8
	06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
10.621			Calculus A	4
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
	11.673	11.674	Physics Laboratory I, II	4

Third Year

10.622			Calculus B	4
	09.664		Design Graphics	4
		02.631	Materials A	4
02.611	02.612		Mechanics A, B	8
		02.614	Stress Analysis A	4

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Fourth Year

02.615		Stress Analysis B	4
	02.621	Thermodynamics A	4
		02.643 Fluid Mechanics A	4
02.673		Measurement & Analysis Lab.	2
	02.674	02.675 Technology Laboratory A, B	4
()		Arts and Sciences Elective	3
	30.306	English II	
	or		3
	30.411	Technical Writing II	
		39.301 Economic Principles and Problems I	3

Fifth Year

02.613		Mechanics C	4
	02.622	Thermodynamics B	4
		02.623 Refrigeration & Air Conditioning	4
05.660		Engineering Economy	4
	02.644	Fluid Mechanics B	4
		02.632 Materials B	
	or		
		02.616 Stress Analysis C	4

Sixth Year

02.630		Heat Transfer	4
	02.680	02.681 Mechanical Design A, B	8
02.676	02.677	02.678 Technology Laboratory C, D, E	6
()	()	() Arts and Sciences Electives	9

Seventh Year

()	()	()	Technical Electives	12
()		()	Arts and Sciences Electives	6
	03.620		Electricity & Electronics	4
()	()		Arts and Sciences Electives	6

Total B.E.T. Degree 180

Suggested Technical Electives

		02.616	Stress Analysis C	4
		02.632	Materials B	4
		02.633	Applied Metallurgy	4
		02.651	Mechanical Vibrations	4
		02.652	Experimental Stress Analysis	4
		02.679	Power Generation	4
	05.582	05.583	Industrial Technology I, II	4
04.381	04.382	04.383	Nuclear Technology I, II, III	6
		06.601	Fortran Engineering Computation	4

Transfer students may petition for elective credits for courses that are suitable to the curriculum.

Graduates of the Bachelor of Engineering Technology program desiring to pursue programs leading to the Bachelor of Science in Engineering degree at Northeastern

University may apply through the Admissions Office (150 RI). Programs in Electrical, Civil, and Mechanical Engineering are available on a part-time as well as a regular day cooperative program. Industrial and Chemical Engineering programs are available only during the regular day programs.

Candidates must have at least a 2.75 cumulative average and complete a course program prescribed by the major department and the Dean's Office.

Note: Associate degree graduates may transfer applicable credits toward the requirements in other Lincoln College programs leading to the Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology degree.

*Before registering for any electives, the student should submit a proposed program of elective courses—preferably representing a minor field of concentration consistent with his or her personal career objectives—for approval by the Academic Standing Committee.

10.623 Calculus C is recommended for all students planning advanced engineering technology subjects.

Mechanical Engineering Technology

(Day Cooperative Curriculum)

(Accredited by Engineers' Council for Professional Development)

*Leading to the Degree of Bachelor of Engineering Technology***First Year**

Course Number			Q.H.	
10.407	10.408	College Algebra & Trigonometry I, II	8	
	10.420	Calculus I	4	
11.417	11.418	11.419	Physics I, II, III	12
30.113		Freshman Writing	4	
	11.473	11.474	Physics Labs. I, II	4
09.470		Engineering Graphics I		
or			4	
06.400		Computer Programming for Eng. Tech.		
	30.114	Introduction to Literature	4	
		30.206	The Literature of Engineering	4
	06.400	Computer Programming for Eng. Tech.		
	or		4	
	09.470	Engineering Graphics I		
		09.471	Engineering Graphics II	4

Second Year

10.421	10.422	Calculus A, B	8
09.464		Engineering Design Graphics	4
	02.412	Mechanics B	4
02.411		Mechanics A	4
	02.414	Stress Analysis A	4
03.420		Electricity & Electronics I	4
	()	Social Science/Humanities Elective	4

Third Year

02.415		Stress Analysis B	4
	02.431	Materials A	4
02.473		Measurement & Analysis Lab.	2
	02.474	Technology Lab. A	2
02.421	02.422	Thermodynamics A, B	8
02.413		Mechanics C	4
	02.443	Fluid Mechanics A	4
39.115		Economic Principles and Problems	4

Fourth Year

02.480	02.481	Mechanical Design A, B	8
02.475	02.476	Technology Labs. B, C	4
02.444		Fluid Mechanics B	4
	02.423	Refrigeration & Air Conditioning	4
02.461		Machine Shop (Industrial Engineering Elective on petition with experience)	4
	()	Social Science/Humanities Elective	4
()		Social Science/Humanities Elective	4

***Note:** Students desiring to terminate their program at the end of Quarter 7 may petition to be awarded the Associate in Engineering degree.

Fifth Year

02.477	02.478	Technology Labs. D, E	4
05.460		Engineering Economy	4
	02.430	Heat Transfer	4
()		Social Science/Humanities Elective	4
	()	Technical Elective	4
()		Technical Elective	4
	()	Social Science/Humanities Elective	4
02.432		Materials B	
		or	4
02.416		Stress Analysis C	
Total B.E.T. Degree			180

Technical Electives Must be Chosen from the Following List:

02.416	Stress Analysis C	4
02.452	Exp. Stress Analysis	4
02.451	Mech. Vibrations	4
02.432	Materials B	4
02.433	Applied Metallurgy	4
02.479	Power Generation	4
10.423	Differential Equations	4
03.421	Electricity & Electronics II	4
03.490	Optical Instrumentation	4
04.481	Nuclear Technology	4

Graduates of the day Bachelor of Engineering Technology program who have maintained a superior level of achievement and who wish to continue their academic studies may be qualified to enter the part-time or full-time program leading to the Bachelor of Science in Engineering. For further information contact the Lincoln College Office at 408 Churchill Hall, telephone 437-2500.

**INTERDISCIPLINARY ENGINEERING AND
SCIENCE TECHNOLOGY PROGRAMS**

These programs offered by Lincoln College present a variety of interdisciplinary combinations of the Engineering Technology programs and the Science programs (chemistry, physics, and mathematics). They have been developed to meet the need for technologists in the areas of ecology, bioelectronic devices, computer systems, and other technological applications requiring an expertise in several of the academic disciplines.

This demand for multi-skilled technologists reflects the increased reliance of society on the science and engineering technologist to help solve its growth problems. Opportunities are also developing in highly interdisciplinary fields such as ocean engineering, bioengineering, environmental science, and public health.

The programs are designed to offer the student the opportunity to prepare to meet the challenge of interfacing technology and society. The engineering technology student not only learns about related disciplines, but also becomes oriented in the disciplines to which his or her technological skills will be applied. A program of concentrated study in chemistry and physics or mathematics and physics is offered to the science technology student.

Interdisciplinary Engineering and Science Technology programs offered to Lincoln College students are:

Associate in Engineering Degree

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Bachelor of Engineering Technology Degree

Mechanical-Structural Engineering Technology	page 102
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Computer Technology**Major Code 036***Leading to the Degree of Associate in Engineering*

The Computer Technology program offers students the opportunity to provide themselves with the mathematical and technological background for understanding both the hardware and software aspects of computer systems, and so will be prepared as: a) programmers who translate engineering, scientific, and business concepts into meaningful form for the computer; b) engineering technicians concerned with the development, specification, production, and operation of computer hardware; and c) applications technicians dealing with the interface of the computer with industrial process and control systems or data acquisition, reduction, and display systems. Job opportunities will also depend on the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.
06.605	10.607	College Algebra	4
	10.608	Introduction to Calculus	4
	10.620	Calculus I	4
		Introduction to Programming	4
	09.670	Engineering Graphics I	4
	06.650	Basic Computer Organization	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
10.621			Calculus A	4
	11.673	11.674	Physics Laboratory I, II	4
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	

Third Year

10.622			Calculus B	4
	06.610		Fortran	4
		06.668	Semiconductor Logic	4
03.651	03.652		Circuits Analysis I, II	8
		30.306	English II	
		or		3
		30.411	Technical Writing II	
		()	Arts and Sciences Elective	3

Fourth Year

06.640		Modern Programming Techniques	4
	06.645	Assembly Language	4
		06.670 Introduction to CPU Hardware	4
06.669		Computer Logic	4
	03.611	Electronics I	4
		06.620 Cobol	4
			<hr/>
Total A.E. Degree			100

Note: Associate degree graduates may transfer applicable credits toward the requirements in other Lincoln College programs leading to the Associate in Engineering, Associate in Science, or Bachelor of Engineering Technology degree.

Computer Technology**Major Code 037***Leading to the Degree of Bachelor of Engineering Technology*

The Computer Technology program offers students the opportunity to prepare themselves to be knowledgeable in both hardware and software. The balance of hardware and software courses combined with hands-on laboratory experience provides the student with the opportunity to develop the skill for interfacing the computer with process plants or machinery. Other employment possibilities exist in programming the computer for engineering, scientific, and business applications; designing, engineering, and testing computers; and interfacing computers with various types of equipment for automated drafting, data collection, and display. Job opportunities will also depend upon the economy and the individual's abilities.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.	
10.607		College Algebra	4	
	10.608	Introduction to Calculus	4	
		10.620	Calculus I	4
06.605		Introduction to Programming		
	09.670	Engineering Graphics I	4	
		06.650	Basic Computer Organization	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
10.621			Calculus A	4
	11.673	11.674	Physics Laboratory I, II	4
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	

Third Year

10.622			Calculus B	4
	06.610		Fortran	4
		06.668	Semiconductor Logic	4
03.651	03.652		Circuits Analysis I, II	8
		30.306	English II	
		or		3
		30.411	Technical Writing II	
		()	Arts and Sciences Elective	3

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Fourth Year

06.640		Modern Programming Techniques	4	
	06.645	Assembly Language	4	
		06.670	Introduction to CPU Hardware	4
06.669		Computer Logic	4	
	03.611	Electronics I	4	
		06.620	Cobol	4

Fifth Year

06.675			CPU Hardware Architecture	4
	06.651		Advanced Computer Organization	4
		06.()	Computer Technical Elective	4
06.630			Non-Numerical Algorithms	4
	()		Arts and Sciences Electives	6
		39.301	Economic Principles and Problems	3
	()	()	Arts and Sciences Elective	6

Sixth Year

06.665		Micro Peripheral Hardware	4	
	06.635	Numerical Algorithms	4	
		06.680	Data Communications Methods	4
06.()		Computer Technical Elective	4	
	()	Arts and Sciences Elective	3	
		()	Technical Elective	4
	()	Arts and Sciences Elective	3	

Seventh Year

06.660			Industry Software	4
	06.665		Industry Hardware	4
		06.()	Computer Technical Elective	4
06.656			Complex Peripheral Hardware	4
	()		Technical Elective	4
		()	Arts and Sciences Elective	3
		()	Arts and Sciences Elective	3

Total B.E.T. Degree 180

Computer Technical Electives

06.681	Operating Systems	4
06.682	Computer Graphics Programming	4
06.683	Data Bases	4
06.684	Large System Assembly Languages	4
06.685	Introduction to Simulation Programming	4
06.686	Device System Hardware	4
06.687	Bit Slice Microcomputers	4
06.688	Micro Controllers	4
06.689	Single Chip Micro Processors	4
06.690	Special Problems in Computer Technology	4

All other technical electives may be chosen from other engineering technology or science disciplines within Lincoln or University College, subject to the department chairman's approval.

Graduates of the Bachelor of Engineering Technology program desiring to pursue programs leading to the Bachelor of Science in Engineering degree at Northeastern University may apply through the Admissions Office (150 RI). Programs in Electrical, Civil, and Mechanical Engineering are available on a part-time as well as a regular cooperative program. Industrial and Chemical Engineering programs are available only during the regular day programs.

Candidates must have at least a 2.75 cumulative average and complete a course program prescribed by the major department and the Dean's Office.

Mechanical-Structural Engineering Technology**Major Code 015**

(Accredited by Engineers' Council for Professional Development)

Leading to the Degree of Bachelor of Engineering Technology

The program in Mechanical-Structural Engineering Technology is interdisciplinary in that it provides the opportunity for students to prepare themselves to assume responsibilities related to both the planning and construction of relatively static structures such as buildings, bridges, and docks, and also the design and production of dynamic machine tools, machinery, and other mechanical devices. The mechanical and structural content is integrated so as to be complementary and to provide a broad base for design problems of great variety. Employment opportunities lie in the architectural, construction, civil, and mechanical professions and companies.

Prerequisite: Satisfactory completion of the Mathematics Placement Test or the Introductory Mathematics I and II courses (10.681 and 10.682). The Mathematics Placement Test must be taken prior to registration.

Each student in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

First Year

Course Number			Q.H.
10.607		College Algebra	4
	10.608	Introduction to Calculus	4
		10.620 Calculus I	4
09.670	09.671	Engineering Graphics I, II	8
	06.600	Computer Programming for Eng. Tech.	4

Second Year

11.617	11.618	11.619	Physics I, II, III	12
10.621			Calculus A	4
	30.305		English I	3
		93.404	Technical Communications	
		or		3
		30.410	Technical Writing I	
	11.673	11.674	Physics Laboratory I, II	4

Third Year

10.622			Calculus B	4
	02.612		Mechanics B	4
		02.631	Materials A	4
02.611			Mechanics A	4
	02.614		Stress Analysis A	4
		02.643	Fluid Mechanics A	4

Fourth Year

02.615			Stress Analysis B	4
	02.644		Fluid Mechanics B	4
		01.621	Introduction to Structural Design	4
02.673			Measurement & Analysis Lab.	2
	02.674	02.675	Technology Laboratory A, B	4
()			Arts and Sciences Elective	3
	30.306		English II	
	or			3
	30.411		Technical Writing II	
		39.501	Economic Principles and Problems I	3

Fifth Year

02.613			Mechanics C	4
	01.625		Structural Analysis II	4
		01.631	Steel Design I	4
01.624			Structural Analysis I	4
()	()	()	Technical Electives	8

Sixth Year

01.632			Steel Design II	4
	01.671	01.672	Concrete Design I, II	8
()			Arts and Sciences Elective	3
	()	()	Technical Electives	8
()	()		Arts and Sciences Electives	6

Seventh Year

	02.680	02.681	Mechanical Design A, B	8
()			Technical Elective	4
()		()	Arts and Sciences Electives	6
	()		Laboratory Elective	2
()	()		Arts and Sciences Electives	6

Total B.E.T. Degree 180

Suggested Technical Electives

01.601	Plane Surveying	4
01.661	Materials & Soil Mechanics	4
01.662	Soil Mechanics & Foundations	4
01.693	Construction Administration	4
02.616	Stress Analysis C	4
02.621	Thermodynamics A	4
02.632	Materials B	4
02.633	Applied Metallurgy	4
02.651	Mechanical Vibrations	4
02.652	Experimental Stress Analysis	4
06.601	Fortran Engineering Computation	4

Elective courses for which proper preparation exists may be chosen from inside or outside of the Mechanical-Structural Engineering discipline.

Transfer students may petition for elective credits for courses that are suitable to the curriculum.

Graduates of the Bachelor of Engineering Technology program desiring to pursue programs leading to the Bachelor of Science in Engineering degree at Northeastern University may apply through the Admissions Office (150 RI). Programs in Electrical, Civil, and Mechanical Engineering are available on a part-time as well as a regular cooperative program. Industrial and Chemical Engineering programs are available only during the regular day programs.

Candidates must have at least a 2.75 cumulative average and complete a course program prescribed by the major department and the Dean's Office.

*Before registering for any electives, the student should submit a proposed program of elective courses—preferably representing a minor field of concentration consistent with his or her personal career objectives—for approval by the Academic Standing Committee.

10.622, 10.623 are recommended for all students planning advanced engineering technology subjects.

description of courses

On the pages which follow is a numerical and descriptive listing of courses offered in the several curricula of Lincoln College. Although not all courses are offered every year, all will be offered during the normal period of each student's curriculum, except for those special courses as defined in the departmental heading of the following course descriptions. The term "prerequisite" indicates a course that must be taken before undertaking the advanced course to which it applies.

A "quarter hour" equals approximately three clock hours of work (ordinarily, one hour of class and two hours of preparation a week for a quarter of 12 weeks' duration). Laboratory and drawing courses normally require fewer hours of outside preparation and therefore carry less credit than lecture courses.

Abbreviations

prereq.—prerequisite
coreq.—corequisite
cl.—class hours

lab.—laboratory hours
q.h.—quarter hours

Policy on Changes of Program

Lincoln College reserves the right to cancel, modify, or add to the courses offered, or to change the order or content of courses in any curriculum.

The University further reserves the right to change the requirements for graduation, tuition, fees charged, and other regulations. However, no change in tuition and fees at any time shall become effective until the school year following that in which it is announced.

Any changes which may be made from time to time relative to the above policy shall be applicable to all students in the school, college, or department concerned, including former students who may re-enroll.

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CIVIL ENGINEERING TECHNOLOGY

01.310 Surveying Laboratory (3 lab., 2 q.h.)

An outdoor lab in use of level, transit, and plane table. Level circuits and a transit-tape traverse are run. Topography and layout problems are given. *Prereq.* 01.601.

01.314 Surveying Practice I (1 cl., 2 lab., 2 q.h.)

Computing and balancing a control traverse; calculating exact property lines, vertical control survey; plotting from topographic field notes. *Prereq.* 01.603.

01.315 Surveying Practice II (1 cl., 2 lab., 2 q.h.)

Scale drawing of the proposed subdivision; calculations required by the land court for the subdivision; street profiles showing grades; drainage study. *Prereq.* 01.314.

01.364 Materials and Soil Mechanics Lab. (3 lab., 2 q.h.)

Grain size analysis; specific gravity; CBR optimum moisture; direct shear; seepage and flow nets; consolidation test. *Prereq.* 01.661.

01.601 Plane Surveying (4 cl., 4 q.h.)

Surveying principles; theory of measurements; leveling; traverse computations; area calculation; stadia principles and topography. *Prereq.* 10.308.

01.602 Geodetic Surveying (2 cl., 3 lab., 4 q.h.)

Introduction to practical astronomy for surveying, including basic spherical trigonometry. Introduction to geodetic surveying, including precise leveling, triangulation, EDM equipment and base line measurements. *Prereq.* 01.601.

01.603 Route Surveying (4 cl., 4 q.h.)

Simple and compound curves; vertical curves; earthwork computations; solution of the mass diagram; introduction to route location by photogrammetry. *Prereq.* 01.601.

01.607 Legal Aspects of Surveying (4 cl., 4 q.h.)

Registry of deeds and probate; ownership of land; deeds, descriptions and qualifying expressions; adverse possession; Massachusetts land court; expert witness. *Prereq.* 01.601.

01.611 Highway Engineering (4 cl., 4 q.h.)

Engineering considerations in the planning and construction of modern highways and highway routing; traffic flow and traffic control; computer applications to transportation problems. *Prereq.* 01.601.

01.616 Land Use Planning (4 cl., 4 q.h.)

Environmental, sociological, economic aspects, and traditional basis for land use planning. Objectives, content, form and preparation of plan. Community and public facilities, transportation; environmental impact and plan implementation. *Prereq.* 09.671.

01.621 Introduction to Structural Design (2 cl., 4 lab., 4 q.h.)

Tabular methods for the design of members and connections using the AISC Code. *Prereq.* 02.614, 09.671.

01.624 Structural Analysis I (4 cl., 4 q.h.)

Reactions, shears, bending moments, and forces developed by loading systems on beams and trusses. Influence lines for beams, girders and trusses; solutions for forces from moving load systems on statically determinate structures. *Prereq.* 02.615.

01.625 Structural Analysis II (4 cl., 4 q.h.)

Classical methods of deflection solution for beams and trusses. Methods of solving statically indeterminate structures. *Prereq.* 01.624.

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01.631 Steel Design I (4 cl., 4 q.h.)

Design of steel members in structural frames; tension, compression, bending and eccentrically loaded members. Design of plate girders for buildings. *Prereq.* 01.621, 02.615.

01.632 Steel Design II (4 cl., 4 q.h.)

Design of steel for highway bridges, composite design in bridges and buildings, introduction to plastic analysis and design in steel. *Prereq.* 01.631.

01.641 Fluid Mechanics (4 cl., 4 q.h.)

Hydrostatics; pressure measurement; hydrostatic forces on submerged areas; simple dams; fluid dynamics; kinematics of flow; continuity, momentum and energy equations; orifices; Pi theorem; laminar and turbulent flow. *Prereq.* 02.614.

01.642 Hydraulics (4 cl., 4 q.h.)

Flow in closed conduits; empirical formulas for closed conduit flow; minor losses; compound pipe systems; open channel flow; specific energy and stage relationships; fluid measurement systems; hydraulic machinery. *Prereq.* 01.641.

01.650 Environmental I (4 cl., 4 q.h.)

Principles of water supply engineering; population forecasting; quality and quantity of water for various uses. Water treatment processes. Collection and disposal of waste water and storm water; modern treatment methods and waste water plant operation. *Prereq.* 12.444 and 01.641.

01.651 Environmental II (2 cl., 4 lab., 4 q.h.)

Layout and design of water treatment and sewage treatment plants. Instrumentation and electrical equipment. Laboratory demonstrations. *Prereq.* 01.650.

01.652 Environmental Lab. (3 lab., 2 q.h.)

Methods and techniques for the physical, chemical, and bacteriological examination of water and waste water, and approaches to treatment through bench scale studies. *Prereq.* 01.650.

01.661 Materials and Soil Mechanics (4 cl., 4 q.h.)

Physical properties of portland cement, aggregates, mixing water and admixtures; batch proportioning; bituminous materials; index properties of soils, soil moisture and structure; compressibility, theory of consolidation. *Prereq.* 02.615.

01.662 Soil Mechanics and Foundations (4 cl., 4 q.h.)

Shear strength of soils, distribution of stress; settlement computations; lateral earth pressures; bearing capacity; soil compaction, soil stabilization and site investigation. *Prereq.* 01.661.

01.671 Concrete Design I (4 cl., 4 q.h.)

Design of bending members, axially and eccentrically loaded columns by elastic and ultimate strength principles. *Prereq.* 02.615.

01.672 Concrete Design II (4 cl., 4 q.h.)

Reinforced concrete design of basic structures, including considerations of continuity. Introduction to prestressed concrete member design. *Prereq.* 01.671.

01.690 Technology of Modern Architecture (4 cl., 4 q.h.)

General background of architectural styles, both historical and contemporary, with emphasis on engineering design and construction procedures required for the various types of buildings.

01.691 Architectural Design I (4 cl., 4 q.h.)

Basic architectural design concepts; proportion, scale form, massing, color texture and lighting. Orientation of structures; site organization; selection of building materials.

Prereq. 09.671, 01.690.

01.692 Architectural Design II (4 cl., 4 q.h.)

Consideration of the building process. Individual architectural design projects assigned by the instructor. *Prereq.* 01.691.

01.693 Construction Administration (4 cl., 4 q.h.)

Contracts, specifications, and bidding procedures; estimating and scheduling, including critical path; discussion of personnel administration and union negotiation. Bid preparation for a small project.

01.694 Civil Engineering Computer Applications (4 cl., 4 q.h.)

An introduction to the systems approach to typical civil engineering problems and their solution using computer applications. *Prereq.* 01.625, 01.650, 01.661, 01.603.

MECHANICAL ENGINEERING TECHNOLOGY

02.411 Mechanics A (4 cl., 4 q.h.) (Day Curriculum)

Forces, moments, couples, statics of particles and rigid bodies in two and three dimensions; distributed forces—external and internal; first moments and centroids; analysis of structure—trusses, frames, and machines. *Prereq.* 10.420 or 10.620, 11.417 or 11.617.

02.412 Mechanics B (4 cl., 4 q.h.) (Day Curriculum)

Friction, second moments, and virtual work; kinematics of particles—rectilinear and curvilinear motion of dynamic particles—force, mass and acceleration, work and energy.

Prereq. 02.411 or 02.611.

02.413 Mechanics C (4 cl., 4 q.h.) (Day Curriculum)

Impulse and momentum of particles; kinematics and dynamics of rigid bodies—force, mass, and acceleration; dynamics of rigid bodies—work and energy, impulse and momentum; introduction to mechanical vibration. *Prereq.* 02.412 or 02.612.

02.414 Stress Analysis A (4 cl., 4 q.h.) (Day Curriculum)

Axially loaded members; stress and strain, allowable stresses, factor of safety, temperature effects, indeterminate members; thin-walled pressure vessels; centric loading of bolted and welded connection. Shear and moment in beams; eccentrically loaded connections; flexural and transverse shearing stresses in beams. *Prereq.* 02.411 or 02.611.

02.415 Stress Analysis B (4 cl., 4 q.h.) (Day Curriculum)

Determinate and indeterminate beam deflections and reactions by integration and area moment methods. Torsional stresses and strains; power transmission; eccentric loads on struts, beams, riveted and welded joints; combined stresses; principal stresses; Mohr's circle; theories of failure. *Prereq.* 02.414 or 02.614

02.416 Stress Analysis C (4 cl., 4 q.h.) (Day Curriculum)
 Curved beams; nonsymmetrical bending of beams; shear-center and shear stresses on thin sections; composite beams. Columns; energy absorption and resilience; inertial stresses, impact loading; deflection of beams by energy methods. Bolted fastenings.
Prereq. 02.415 or 02.615.

02.419 Mechanics (4 cl., 4 q.h.) (Day Curriculum)
 A mechanics course for nonmechanical students. *Prereq.* 10.420 or 10.620, 11.417 or 11.617.

02.421 Thermodynamics A (4 cl., 4 q.h.) (Day Curriculum)
 General theory of heat and matter; laws of thermodynamics; energy-transformation principles and availability of energy; properties and processes for pure substances and ideal gases. Thermodynamic properties and processes of liquids and vapors; tables and charts; mixtures of fluids; vapor cycles. *Prereq.* 11.418 or 11.618.

02.422 Thermodynamics B (4 cl., 4 q.h.) (Day Curriculum)
 Theory of vapor engines and analysis of types of actual engines using compression of gases and vapors; internal combustion engines. Theory of gas and vapor flow through orifices and nozzles. Design and performance of steam and gas turbines; spark-ignition and compression-ignition engine design and performance. Fan performance.
Prereq. 02.421 or 02.621.

02.423 Refrigeration & Air Conditioning (4 cl., 4 q.h.) (Day Curriculum)
 Air conditioning principles, including psychometrics and heat pumps. Calculation of heating and cooling loads in accordance with A.S.H.R.A.E. practices. Principles of gas compression; analysis of vapor compression; refrigeration systems; low temperature refrigeration cycles; and absorption refrigeration systems. *Prereq.* 02.422 or 02.622.

02.430 Heat Transfer ((4 cl., 4 q.h.) (Day Curriculum)
 The primary modes of heat transfer; thermal conductivity; thermal conductance/resistance concept; thermal-electrical analogy; combined heat transfer mechanisms, basic equations of conduction; analytical solutions of various steady state conduction problems. Dimensional analysis and similarity considerations; natural and forced convection; hydrodynamic and thermal boundary layers; black body radiation; Kirchhoff's law; emissivity and absorptivity; radiation between simple bodies; numerical methods. Log mean temperature differences; overall heat transfer coefficients; heat exchanger effectiveness; tubular exchanger design; regenerative and evaporative heat exchangers; heat transfer engineering problems. *Prereq.* 02.422 or 02.622.

02.431 Materials A (4 cl., 4 q.h.) (Day Curriculum)
 Lectures on: fundamental metallic structures; general metallurgical information covering theoretical aspects of properties; testing and failure of metals; supplemented by visual aids. Lectures on: alloying and hardening of metals; refinement of metals; equilibrium diagrams; characteristics of engineering metals; principles of metal fabrication.

02.432 Materials B (4 cl., 4 q.h.) (Day Curriculum)
 Lectures on: inorganic materials, i.e., polymers, glasses, ceramics, cements, wood, and materials having important electrical and magnetic properties; also a summary of the most up-to-date applications for the fabrication and uses of both metals and nonmetals. Structures of metals; imperfections; phase diagrams; effect of temperature on structure and properties of metals (annealing, recrystallization, recovery, precipitation, diffusion); strengthening mechanisms; mechanical properties of nonferrous metals.

Laboratory: experiments in preparation of samples, selection, polishing, and etching; examination of nonferrous metals; use of the microscope; linear analysis; construction of cooling curves; and simple binary phase diagrams. *Prereq.* 02.431 or 02.631.

02.433 Applied Metallurgy (4 cl., 4 q.h.) (Day Curriculum)

Lectures on: mechanical properties of ferrous metals, the iron carbon diagram, high temperature alloys, hardening methods, impact tests, effects of environment on metals; manufacturing processes; methods of fabrication; limitations on the use of different materials and processes; casting, welding, cutting, drawing, powder metallurgy.

Laboratory: experiments on analysis of stress-strain diagrams of iron and steel, heat treatment of steels, surface corrosion, tempering and drawing, use of metallograph and analysis of the results. Experiments in cold rolling, swaging, drawing of nonferrous metals and the analysis of the results. Tension, shear, fatigue, and machinability tests on ferrous metals. *Prereq.* 02.432 or 02.632.

02.443 Fluid Mechanics A (4 cl., 4 q.h.) (Day Curriculum)

Hydrostatics, principles governing fluids at rest; pressure measurement; hydrostatic forces on submerged areas and objects; simple dams; fluids in moving vessels; hoop tension. Fluid flow in pipes under pressure; fluid energy, power and friction loss; Bernoulli's Theorem; flow measurement. *Prereq.* 02.412 or 02.612.

02.444 Fluid Mechanics B (4 cl., 4 q.h.) (Day Curriculum)

Pipe networks and reservoir systems; flow in open channels; uniform flow; energy, friction loss, minor losses, velocity distribution, alternate stages of flow, critical flow; nonuniform flow; accelerated and retarded flow; hydraulic jump and waves. *Prereq.* 02.443 or 02.643.

02.451 Mechanical Vibrations (4 cl., 4 q.h.) (Day Curriculum)

Elements of vibrating systems, one degree of freedom (undamped free and forced vibration from Newton's law of motion and energy methods); natural frequencies; damped free and forced vibration; impedance and mobility; systems with more than one degree of freedom; influence coefficients, Lagrange's equations, generalized coordinates, vibration absorber. *Prereq.* 02.413 or 02.613.

02.452 Experimental Stress Analysis (4 cl., 4 q.h.) (Day Curriculum)

Theory and experimentation showing the application of extensometers and electrical strain gauges and as transducers in the field of experimental stress and strain analysis. Theory and laboratory practice on photoelastic methods as applied to classical model analysis and modern coating analysis. *Prereq.* 02.415 or 02.615.

02.461 Machine Shop (2 cl., 3 lab., 4 q.h.) (Day Curriculum)

Introduction to study of machines for metal processing, cutting tools, and fluids; machinability; automatic machinery. *Prereq.* none.

02.473 Measurement & Analysis Laboratory (3 lab., 2 q.h.) (Day Curriculum)

Experimental procedures for the collection and analysis of data by graphical and numerical methods, including computer applications, report writing that draws conclusions which are relative to accuracy, precision, true values, and measured values as they are related to basic mechanical measuring instruments for length, area, volume, specific gravity, pressure, temperature, and time as these parameters are utilized in making mechanical measurements. *Prereq.* 02.414 or 02.614, 06.400 or 06.600, 10.422 or 10.622, 11.419 or 11.619.

02.474 Technology Laboratory A (3 lab., 2 q.h.) (Day Curriculum)

Experimental procedures to determine mechanical properties of materials under tensile, compressive, torsional, direct shear, flexural, impact, fatigue, and creep loading conditions as they are affected by environmental conditions that are normal and abnormal; also as they are affected by homogeneity, nonhomogeneity, isotropy, and nonisotropy.

Prereq. 02.473 or 02.673, 02.415 or 02.615, 03.431 or 02.631, or concurrently.

02.475 Technology Laboratory B (3 lab., 2 q.h.) (Day Curriculum)

Experimental procedures to determine the physical properties of incompressible fluids, measure the flow rates and velocities utilizing pitot tubes, orifice plates, venturii meter, and weirs flow meters, U tube differential manometers, and piezometers as the fluid flows through open channels, partially filled conduits, conduits under pressure, pipe networks, turbines, and pumps. *Prereq.* 02.473 or 02.673, 02.443 or 02.643, or concurrently.

02.476 Technology Laboratory C (3 lab., 2 q.h.) (Day Curriculum)

Basic thermodynamic relationships; experimental procedures to examine the flow of compressible fluids and steam; examine the energy conversion of a fuel into a working substance and the related heat transfer mechanisms. Operating characteristics of thermal generators, engines, and compressors. *Prereq.* 02.473 or 02.673, 02.422 or 02.622, or concurrently.

02.477 Technology Laboratory D (3 lab., 2 q.h.) (Day Curriculum)

Experimental procedures to examine the operating characteristics and efficiencies of internal combustion engines, brake horsepower, indicated horsepower, friction horsepower, mean effective pressure, fuel consumption, torque, ignition timing, manifold pressure, and compression ratios and internal engines as energy conversion systems; energy conversion of fuels. *Prereq.* 02.476 or 02.676, 02.422 or 02.622, 02.430 or 02.630, or concurrently.

02.478 Technology Laboratory E (3 lab., 2 q.h.) (Day Curriculum)

Experimental procedures of a project nature to examine refrigeration, air conditioning, and heating pump cycles. A project of analytical, design, or experimental nature. Experiments of advanced or specialized nature. *Prereq.* 02.473 or 02.673, 02.423 or 02.623, 02.430 or 02.630.

02.479 Power Generation (4 cl., 4 q.h.) (Day Curriculum)

Basic power generation cycles; gas turbine cycles; effects of combustor temperature, intercooling, etc. on cycle performance; Rankine regenerative cycles; effects of steam temperature, pressure, number of feedwater heaters, etc. upon performance; steam generation equipment: boilers, reactors.

Fossil fuel characteristics and effects on boiler design; combustion analysis; draft calculations; axial and centrifugal fan performance characteristics; pump design and performance considerations; heat exchanger design considerations.

Applications of principles of economics to cycle and performance considerations; use of load curves; economic considerations of heat rate; economics of equipment selection; study of auxiliary equipment such as precipitators and flue gas desulfurization systems.

Prereq. 02.422 or 02.622.

02.480 Mechanical Design A (4 cl., 4 q.h.) (Day Curriculum)

Introduction to mechanical design, the design process, design factors, creativity, optimization, human factors, value engineering. These principles discussed and developed in an introductory manner through simple design projects.

Principles of design, properties, and selection of materials; stress concentrations; strength under combined stresses; theories of failure; impact and fluctuating and repeated loads. *Prereq.* 02.415 or 02.615 or 02.431 or 02.631.

02.481 Mechanical Design B (4 cl., 4 q.h.) (Day Curriculum)

Stresses; deformation and design of fasteners, screws, joints, springs, and bearings; lubrication and journal bearings.

Stresses and power transmission of spur, bevel, and worm gear; shaft design; clutches and brakes. *Prereq.* 02.480 or 02.680.

02.499 Special Problems in Mechanical Engineering Technology (4 q.h.)

(Day Curriculum)

Theoretical or experimental work under individual faculty supervision. *Prereq.* *Consent of department chairman.*

02.598 Special Problems in Mechanical Engineering Technology (2 q.h.)

Theoretical or experimental work under individual faculty supervision. *Prereq.* *Consent of department chairman.*

02.599 Special Problems in Mechanical Engineering Technology (4 q.h.)

Theoretical or experimental work under individual faculty supervision. *Prereq.* *Consent of department chairman.*

02.611 Mechanics A (4 cl., 4 q.h.)

Forces; moments, couples, statics of particles and rigid bodies in two and three dimensions; distributed forces—external and internal; first moments and centroids; analysis of structure-trusses, frames, and machines. *Prereq.* 10.420 or 10.620, 11.417 or 11.617.

02.612 Mechanics B (4 cl., 4 q.h.)

Friction, second moments, and virtual work; kinematics of particles-rectilinear and curvilinear motion of dynamic particles—force, mass and acceleration, work and energy.

Prereq. 02.411 or 02.611.

02.613 Mechanics C (4 cl., 4 q.h.)

Impulse and momentum of particles; kinematics and dynamics of rigid bodies—force—mass, and acceleration; dynamics of rigid bodies—work and energy. Impulse and momentum; introduction to mechanical vibration. *Prereq.* 02.412 or 02.612.

02.614 Stress Analysis A (4 cl., 4 q.h.)

Axially loaded members; stress and strain, allowable stresses, factor of safety, temperature effects, indeterminate members; thin-walled pressure vessels; centric loading of bolted and welded connection. Shear and moment in beams; eccentrically loaded connections; flexural and transverse shearing stresses in beams. *Prereq.* 02.411 or 02.611.

02.615 Stress Analysis B (4 cl., 4 q.h.)

Determinate and indeterminate beam deflections and reactions by integration and area moment methods. Torsional stresses and strains; power transmission; eccentric loads on struts, beams, riveted and welded joints; combined stresses; principal stresses; Mohr's circle theories of failure. *Prereq.* 02.414 or 02.614.

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02.616 Stress Analysis C (4 cl., 4 q.h.)

Curved beams; nonsymmetrical bending of beams; shear-center and shear stresses on thin sections; composite beams. Columns; energy absorption and resilience; inertial stresses, impact loading; deflection of beams by energy methods. Bolted fastenings.
Prereq. 02.415 or 02.615.

02.621 Thermodynamics A (4 cl., 4 q.h.)

General theory of heat and matter; laws of thermodynamics; energy-transformation principles and availability of energy; properties and processes for pure substances and ideal gases. Thermodynamic properties and processes of liquids and vapors; tables and charts; mixtures of fluids; vapor cycles. *Prereq.* 11.418 or 11.618.

02.622 Thermodynamics B (4 cl., 4 q.h.)

Theory of vapor engines and analysis of types of actual engines using compression of gases and vapors; internal combustion engines. Theory of gas and vapor flow through orifices and nozzles. Design and performance of steam and gas turbines; spark-ignition and compression-ignition engine design and performance. Fan performance.
Prereq. 02.421 or 02.621.

02.623 Refrigeration & Air Conditioning (4 cl., 4 q.h.)

Air conditioning principles, including psychometrics and heat pumps. Calculation of heating and cooling loads in accordance with A.S.H.R.A.E. practices. Principles of gas compression; analysis of vapor compression; refrigeration systems; low temperature refrigeration cycles; and absorption refrigeration systems. *Prereq.* 02.422 or 02.622.

02.630 Heat Transfer (4 cl., 4 q.h.)

The primary modes of heat transfer; thermal conductivity; thermal conductance/resistance concept; thermal-electrical analogy; combined heat transfer mechanisms, basic equations of conduction; analytical solutions of various steady state conduction problems. Dimensional analysis and similarity considerations; natural and forced convection; hydrodynamic and thermal boundary layers; black body radiation; Kirchhoff's law; emissivity and absorptivity; radiation between simple bodies; numerical methods. Log mean temperature differences; overall heat transfer coefficients; heat exchanger effectiveness; tubular exchanger design; regenerative and evaporative heat exchangers; heat transfer engineering problems. *Prereq.* 02.422 or 02.622.

02.631 Materials A (4 cl., 4 q.h.)

Lectures on: fundamental metallic structures; general metallurgical information covering theoretical aspects of properties; testing and failure of metals; supplemented by visual aids. Lectures on: alloying and hardening of metals; refinement of metals; equilibrium diagrams; characteristics of engineering metals; principles of metal fabrication.

02.632 Materials B (4 cl., 4 q.h.)

Lectures on: inorganic materials, i.e., polymers, glasses, ceramics, cements, wood, and materials having important electrical and magnetic properties; also a summary of the most up-to-date applications for the fabrication and uses of both metals and nonmetals. Structures of metals; imperfections; phase diagrams; effect of temperature on structure and properties of metals (annealing, recrystallization, recovery, precipitation, diffusion); strengthening mechanisms; mechanical properties of nonferrous metals. Laboratory: experiments in preparation of samples, selection, polishing, and etching,

examination of nonferrous metals; use of the microscope; linear analysis; construction of cooling curves; and simple binary phase diagrams. *Prereq.* 02.431 or 02.631.

02.633 Applied Metallurgy (4 cl., 4 q.h.)

Lectures on: mechanical properties of ferrous metals, the iron carbon diagram, high temperature alloys, hardening methods, impact tests, effects of environment on metals; manufacturing processes; methods of fabrication; limitations on the use of different materials and processes; casting, welding, cutting, drawing, powder metallurgy.

Laboratory: experiments on analysis of stress-strain diagrams of iron and steel, heat treatment of steels, surface corrosion, tempering and drawing, use of metallograph and analysis of the results. Experiments in cold rolling, swaging, drawing of nonferrous metals and the analysis of the results. Tension, shear, fatigue, and machinability tests on ferrous metals. *Prereq.* 02.432 or 02.632.

02.643 Fluid Mechanics A (4 cl., 4 q.h.)

Hydrostatics, principles governing fluids at rest; pressure measurement; hydrostatic forces on submerged areas and objects; simple dams; fluids in moving vessels; hoop tension. Fluid flow in pipes under pressure; fluid energy, power and friction loss; Bernoulli's Theorem; flow measurement. *Prereq.* 02.412 or 02.612.

02.644 Fluid Mechanics B (4 cl., 4 q.h.)

Pipe networks and reservoir systems; flow in open channels; uniform flow; energy, friction loss, minor losses, velocity distribution, alternate stages of flow, critical flow; nonuniform flow; accelerated and retarded flow; hydraulic jump and waves. *Prereq.* 02.443 or 02.643.

02.651 Mechanical Vibrations (4 cl., 4 q.h.)

Elements of vibrating systems, one degree of freedom (undamped free and forced vibration from Newton's law of motion and energy methods); natural frequencies; damped free and forced vibration; impedance and mobility, systems with more than one degree of freedom; influence coefficients. Lagrange's equations, generalized coordinates, vibration absorber. *Prereq.* 02.413 or 02.613.

02.652 Experimental Stress Analysis (4 cl., 4 q.h.)

Theory and experimentation showing the application of extensometers and electrical strain gauges as transducers in the field of experimental stress and strain analysis. Theory and laboratory practice on photoelastic methods as applied to classical model analysis and modern coating analysis. *Prereq.* 02.415 or 02.615.

02.673 Measurement & Analysis Laboratory (3 lab., 2 q.h.)

Experimental procedures for the collection and analysis of data by graphical and numerical methods, including computer applications, report writing that draws conclusions which are relative to accuracy, precision, true values, and measured values as they are related to basic mechanical measuring instruments for length, area, volume, specific gravity, pressure, temperature, and time as these parameters are utilized in making mechanical measurements. *Prereq.* 02.414 or 02.614, 06.400 or 06.600, 10.422 or 10.622, 11.419 or 11.619.

02.674 Technology Laboratory A (3 lab., 2 q.h.)

Experimental procedures to determine mechanical properties of materials under tensile, compressive, torsional, direct shear, flexural, impact, fatigue, and creep loading conditions as they are affected by environmental conditions that are normal and abnormal; also as they are affected by homogeneity, nonhomogeneity, isotropy, and nonisotropy.
Prereq. 02.473 or 02.673, 02.415 or 02.615, 02.431 or 02.631, or concurrently.

02.675 Technology Laboratory B (3 lab., 2 q.h.)

Experimental procedures to determine the physical properties of incompressible fluids, measure the flow rates and velocities utilizing pitot tubes, orifice plates, venturii meter, and weirs flow meters, U tube differential manometers, and piezometers as the fluid flows through open channels, partially filled conduits, conduits under pressure, pipe networks, turbines, and pumps. *Prereq.* 02.473 or 02.673, 02.443 or 02.643, or concurrently.

02.676 Technology Laboratory C (3 lab., 2 q.h.)

Basic thermodynamic relationships; experimental procedures to examine the flow of compressible fluids and steam; examine the energy conversion of a fuel into a working substance and the related heat transfer mechanisms. Operating characteristics of thermal generators, engines, and compressors. *Prereq.* 02.473 or 02.673, 02.422 or 02.622, or concurrently.

02.677 Technology Laboratory D (3 lab., 2 q.h.)

Experimental procedures to examine the operating characteristics and efficiencies of internal combustion engines, brake horsepower, indicated horsepower, mean effective pressure, fuel consumption, torque, ignition timing, manifold pressure, and compression ratios and internal engines as energy conversion systems; energy conversion of fuels.
Prereq. 02.476 or 02.676, 02.422 or 02.622, 02.430 or 02.630, or concurrently.

02.678 Technology Laboratory E (3 lab., 2 q.h.)

Experimental procedures of a project nature to examine refrigeration, air conditioning, and heating pump cycles. A project of analytical, design, or experimental nature. Experiments of advanced or specialized nature. *Prereq.* 02.473 or 02.673, 02.423 or 02.623, 02.430 or 02.630.

02.679 Power Generation (4 cl., 4 q.h.)

Basic power generation cycles; gas turbine cycles; effects of combustor temperature, intercooling, etc. on cycle performance; Rankine regenerative cycles; effects of steam temperature, pressure, number of feedwater heaters, etc. upon performance; steam generation equipment: boilers, reactors.

Fossil fuel characteristics and effects on boiler design; combustion analysis; draft calculations; axial and centrifugal fan performance characteristics; pump design and performance considerations; heat exchanger design considerations.

Applications of principles of economics to cycle and performance considerations; use of load curves; economic considerations of heat rate; economics of equipment selection; study of auxiliary equipment, such as precipitators and flue gas desulfurization systems.
Prereq. 02.422, 02.622, or 02.678.

02.680 Mechanical Design A (4 cl., 4 q.h.)

Introduction to mechanical design, the design process, design factors, creativity, optimization, human factors, value engineering. These principles discussed and developed in an introductory manner through simple design projects.

Principles of design, properties and selection of materials; stress concentrations; strength under combined stresses; theories of failure; impact and fluctuating and repeated loads.
Prereq. 02.415 or 02.615 or 02.431 or 02.631.

02.681 Mechanical Design B (4 cl., 4 q.h.)

Stresses; deformation and design of fasteners, screws, joints, springs, and bearings, lubrication and journal bearings.

Stresses and power transmission of spur, bevel, and worm gear; shaft design; clutches and brakes. *Prereq.* 02.480 or 02.680.

ELECTRICAL ENGINEERING TECHNOLOGY**03.301 Circuit Theory I** (2 cl., 2 q.h.)

Ohm's law; Kirchhoff's current and voltage laws; equivalent resistances and sources; mesh and nodal analysis; network theorems; and power relations, all with respect to direct currents. *Prereq.* 10.620, 11.619.

03.302 Circuit Theory II (2 cl., 2 q.h.)

Energy storage; singularity functions; response of R, L, and C elements to singularities. *Prereq.* 03.301, 10.621, or concurrently.

03.303 Circuit Theory III (2 cl., 2 q.h.)

Complex algebra; phasors; frequency domain; mutual inductance; transformers; steady-state a-c theory; driving point and transfer impedances; power and energy in a-c circuits. *Prereq.* 03.451 or 03.651.

03.304 Circuit Theory IV (2 cl., 2 q.h.)

Laplace transforms; partial fraction expansion; Laplace transform techniques applied to the solution of RLC networks. *Prereq.* 03.303.

03.305 Circuit Theory V (2 cl., 2 q.h.)

Consideration of balanced and unbalanced polyphase power circuits; symmetrical components; harmonic analysis. *Prereq.* 03.452 or 03.652.

03.330 Microwave Measurements (2 cl., 2 q.h.)

A discussion of basic microwave measurements techniques including continuous wave versus swept systems; analysis of detectors, insertion loss, attenuators, filters, return loss, couplers, insulators, amplifiers, audative devices. *Prereq.* 03.429 or 03.629.

03.341 Power and Controls Laboratory I (2½ lab., 2 q.h.)

These experiments introduce the student to standard laboratory measurement equipment, including voltmeter, ammeters, oscilloscopes, and frequency counters as well as data-taking methods and report writing. Devices investigated include diodes, bipolar transistors, field effect devices, silicon control rectifiers, unijunction transistor, power supplies, regulators, and various types of feedback transistor amplifiers. *Prereq.* 03.430 or 03.630.

03.342 Power and Controls Laboratory II (2½ lab., 2 q.h.)

Experiments with characteristics of DC motors and generators, single and multiple phase transformers, induction motors, synchronous motors and 3 phase power measurements. *Prereq.* 03.341.

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03.343 Power and Controls Laboratory III (2½ lab., 2 q.h.)

Experiments with self-synchronous devices such as control transformers, transmitters and receivers, AC and DC servomotors, open and closed loop response of servo mechanisms and stepping motors. *Prereq.* 03.342.

03.349 Advanced Electronics Laboratory IV (2½ lab., 2 q.h.)

Electronic engineering exercises selected from the following topics: transistor amplifier design, operational amplifiers, analog computation, Fourier optics, acoustics, and micro-waves. *Prereq.* 03.429 or 03.629.

03.350 Advanced Electronics Laboratory V (2½ lab., 2 q.h.)

Design projects laboratory. Students will be directed in design of such projects as motor speed control, DC-DC converter, high current pulse amplifiers, etc. *Prereq.* 03.349.

03.381 Linear Active Circuit Design I (2 cl., 2 q.h.)

Effects of feedback on impedance levels, frequency response and distortion. Use of block diagram algebra and computation of transfer functions, frequency response. Stability of feedback circuits, Nyquist, Bode and Nichols plots. Applications of Op-Amp circuits in integrators, differentiators, and active filters. *Prereq.* 03.413 or 03.613.

03.382 Linear Active Circuit Design II (2 cl., 2 q.h.)

Building blocks for multistage amplifiers. Analysis of differential amplifier stages, drifts, offset, CM rejection ratio. High frequency behavior of transistors. Frequency response of multi-stage transistor amplifiers. Compensation techniques in feedback amplifiers. *Prereq.* 03.381.

03.383 Linear Active Circuit Design III (2 cl., 2 q.h.)

Applications of Op-Amps. Function generators, comparators, sample and hold D/A, A/D converters, oscillators, phase locked loops. Power amplifiers class A, B, AB, and C. Thermal analysis of power circuits. Switching amplifiers. *Prereq.* 03.382.

03.396 Basic Optics for Instrumentation (2 cl., 2 q.h.)

Provides the necessary background for the two instrumentation courses listed below. Includes basic topics in geometrical and physical optics. No previous background in optics is assumed. Topics included are: Gaussian optics, fundamental laws of image formation, basic elements of optical design, scalar wave theory, interference and diffraction, polarization, basics of coherent (laser) and noncoherent optics. *Prereq.* 10.408 or 10.608.

03.397 Optical Instrumentation I (2 cl., 2 q.h.)

Treats the classical image-forming instruments (telescopes, microscopes, etc.) as components of optical systems. Includes magnification, aberrations, resolution criteria, photometry, compatibility of system components and optimization of systems. Topics in coherent imaging, such as phase contrast and holography. *Prereq.* 03.396.

03.398 Optical Instrumentation II (2 cl., 2 q.h.)

The basic nonimage forming systems used for analysis control and metrology. Includes spectroscopy, interferometry (classical and holographic), electron-ion optical, and X-ray systems. *Prereq.* 03.397.

- 03.410 Electrical Measurements** (4 cl., 4 q.h.) (Day Curriculum)
Standards of measurements, dimensional analysis, errors and measurement of dispersed data, discrete and continuous variables, binomial distribution, normal distribution, guaranteed error, methods of resistance measurements, digital voltmeters and analog to digital conversion, voltage references, potentiometers and a.c. bridges. *Prereq.* 03.453 or 03.653.
- 03.411 Electronics I** (4 cl., 4 q.h.) (Day Curriculum)
Semiconductor diodes and applications, transistor biasing techniques, graphical analysis of basic amplifiers, d.c. and a.c. load lines. *Prereq.* 03.452 or 03.652.
- 03.412 Electronics II** (4 cl., 4 q.h.) (Day Curriculum)
Small-signal, low-frequency transistor models, gains, and impedances at midband, frequency effects in transistor circuits, multistage circuits, transistors used as current sources. *Prereq.* 03.411 or 03.611.
- 03.413 Electronics III** (4 cl., 4 q.h.) (Day Curriculum)
Review of Bode plots, transistor circuits at low and high frequencies, feedback, operational amplifiers, differential amplifiers, applications. *Prereq.* 03.412 or 03.612.
- 03.414 Pulse & Digital I** (4 cl., 4 q.h.) (Day Curriculum)
Switching characteristics of semiconductor devices; wave generation and shaping, using combinations of passive and integrated circuit components; comparators, hysteresis, and the dual ramp analog to digital converter-voltmeter circuits; voltage to frequency conversion. *Prereq.* 03.411 or 03.611.
- 03.415 Pulse & Digital II** (4 cl., 4 q.h.) (Day Curriculum)
Digital operations; logic statements and theorems; minimization of logic functions; logic gates and the characteristics of the integrated logic families; flip-flops counters and registers; introduction to sequential circuit design; sample and hold circuits; analog to digital conversion. *Prereq.* 03.414 or 03.614.
- 03.417 Principles of Communication Systems I** (4 cl., 4 q.h.) (Day Curriculum)
Signal analysis using Fourier methods; noise in communication systems; frequency selective amplifiers including wideband; transistor power amplifiers AF and RF; oscillators; signal sources and applications. *Prereq.* 03.413 or 03.613.
- 03.418 Principles of Communication Systems II** (4 cl., 4 q.h.) (Day Curriculum)
Basic theory of amplitude, frequency, phase and pulse code modulated systems; analysis of modulating and demodulating circuits; carrier systems using SSB; system block and level diagrams; logic control circuits in communication systems; modems. *Prereq.* 03.417 or 03.617.
- 03.419 Principles of Communication Systems III** (4 cl., 4 q.h.) (Day Curriculum)
Fundamentals of digital communications; sampling requirements; analog to digital conversion methods; system capacity and bandwidth; comparison of practical digital systems PAM, PCM, PFM, PWM; time and frequency division multiplexing; data decoding; selected examples from telemetry and computer links. *Prereq.* 03.418 or 03.618.

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- 03.420 Electricity and Electronics I** (4 cl., 4 q.h.) (Day Curriculum)
Introduction to circuit analysis, resistive networks, periodic excitation function, steady state a-c circuits; the physical foundations of electronics and the physical operation of electronic devices. *Prereq.* 10.420 or 10.620, 11.419 or 11.619.
- 03.421 Electricity and Electronics II** (4 cl., 4 q.h.) (Day Curriculum)
Single-stage electronic circuits, magnetic circuits and transformers, electro mechanical energy conversion, d-c machines, a-c machines. *Prereq.* 03.420 or 03.620.
- 03.423 Electronics Laboratory** (3 lab., 2 q.h.) (Day Curriculum)
Experiments dealing with laboratory equipment (meters and oscilloscopes) techniques; junction and field-effect transistor characteristics; vacuum and semiconductor diodes; power supplies, including the regulated type; silicon controlled rectifiers; resistance-coupled amplifiers using transistors, including feedback methods. *Prereq.* 03.412 or 03.612, or concurrently.
- 03.424 Circuits Laboratory I** (3 lab., 2 q.h.) (Day Curriculum)
Experimentation in electronic circuit theory utilizing various measurement techniques. Instrumentation verification of circuit theorems; response of circuits to steps and impulses; oscilloscope theory and applications. *Prereq.* 03.451 or 03.651.
- 03.425 Circuits Laboratory II** (3 lab., 2 q.h.) (Day Curriculum)
Further experimentation in electrical circuits and measurement techniques. Experiments include response of circuits to steps and impulses, nonlinear devices, terminal characteristics of active devices, log modulus plots, network parameters and synthesis. Fourier analysis and synthesis. *Prereq.* 03.424 or 03.624.
- 03.427 Advanced Electronics Laboratory I** (3 lab., 2 q.h.) (Day Curriculum)
Experiments dealing with the use of oscilloscopes, the examination of transistor audio amplifiers, push-pull amplifiers, drivers, pulse and video amplifiers, transients and wave-shaping circuits, audio frequency oscillators, and the study of operational amplifiers. *Prereq.* 03.423 or 03.623.
- 03.428 Advanced Electronics Laboratory II** (3 lab., 2 q.h.) (Day Curriculum)
Experiments dealing with the modulation of a class C amplifier, the diode detector, basic timing circuits, RF and crystal oscillators, astable multivibrators, logic gates, flip-flops, binary adders, registers and counters; active filters, frequency modulation detectors, and analog-to-digital and digital-to-analog conversion. *Prereq.* 03.427 or 03.627.
- 03.429 Advanced Electronics Laboratory III** (3 lab., 2 q.h.) (Day Curriculum)
Spectral studies of FM and PM waves, amplitude limiters; the balanced modulators and single sideband generators; integrated circuit timers and monolithic random access memory; monolithic phase-locked loop as well as a series of microwave experiments and a series of digital experiments. *Prereq.* 03.428 or 03.628.
- 03.430 Energy Conversion** (4 cl., 4 q.h.) (Day Curriculum)
Generalized theory of rotating energy conversion devices; steady-state operation of the multiply-excited direct-current machine; control of speed; special machines; transformers; steady-state considerations of induction and synchronous machines; generalized machine and circuit model; Laplace transform techniques applied to the analysis of dynamic operating modes of rotating machines. *Prereq.* 03.452 or 03.652 and 10.422 or 10.622.

03.437 Distributed Systems (4 cl., 4 q.h.) (Day Curriculum)

Radiation, transmission, and reception of electromagnetic waves; distributed-line constants and traveling waves of transmission lines; differential equations of the uniform line. *Prereq.* 10.422 or 10.622 and 11.419 or 11.619.

03.451 Circuits Analysis I (4 cl., 4 q.h.) (Day Curriculum)

Ohm's law, Kirchhoff's current and voltage laws, equivalent resistances and sources, mesh and nodal analysis, network theorems, two-port networks and power relations—all with respect to direct currents; energy storage, singularity functions, response of R, L, and C elements to singularities. *Prereq.* 10.420 or 10.620 and 11.419 or 11.619.

03.452 Circuits Analysis II (4 cl., 4 q.h.) (Day Curriculum)

Complex algebra, phasors, frequency domain, mutual inductance, transformers, steady-state a-c theory, driving point and transfer impedances, power and energy in a-c circuits; Laplace transforms; partial fraction expansion; Laplace transform techniques applied to the solution of RLC networks. *Prereq.* 03.451 or 03.651.

03.453 Circuits Analysis III (4 cl., 4 q.h.) (Day Curriculum)

Application of differential equations to the solutions of linear, time-invariant electrical networks; introduction to singularity functions, convolution, and time domain transient analysis; network topology and duality; introduction to the methods of transformation calculus and complex frequency concepts. *Prereq.* 03.452 or 03.652.

03.454 Circuits Analysis IV (4 cl., 4 q.h.) (Day Curriculum)

Signal analysis in the frequency domain; Fourier series; Fourier and Laplace transform methods; a varied selection of circuit problems is solved using Laplace transforms and related theorems. *Prereq.* 03.453 or 03.653.

03.460 Engineering Analysis I (4 cl., 4 q.h.) (Day Curriculum)

Linear algebra and its application to circuit equations; solution of linear differential equations including an introduction to Laplace transforms. *Prereq.* 10.422 or 10.622 and 03.452 or 03.652.

03.462 Basic Power Systems I (4 cl., 4 q.h.) (Day Curriculum)

Consideration of power transmission lines; line constants; current voltage and power relations; introduction to electric-power distribution loads, feeders, and substations; application of matrices. *Prereq.* 03.454 or 03.654.

03.463 Basic Power Systems II (4 cl., 4 q.h.) (Day Curriculum)

Consideration of symmetrical and unsymmetrical faults; protective devices—application and coordination; power flow in electric circuits; steady-state power limitations of systems; voltage regulation theory and application. *Prereq.* 03.462 or 03.662.

03.464 Basic Power Systems III (4 cl., 4 q.h.) (Day Curriculum)

Computer applications to power systems with emphasis on load-flow studies; basic ideas of systems planning, short-circuit studies and system stability. *Prereq.* 03.463 or 03.663.

122 / DESCRIPTION OF COURSES

- 03.470 Digital Computers** (4 cl., 4 q.h.) (Day Curriculum)
Introduction to the field of digital computer design. Topics include general computer organization, number systems and number representations, design characteristics of major computer units, Boolean Algebra applications to computer design. *Prereq.* 03.411 or 03.611.
- 03.471 Digital Computers II** (4 cl., 4 q.h.) (Day Curriculum)
Examination of microprocessor architecture and organization. Study of the machine language and assembly coding of an industry-accepted microprocessor. A suitable topic selected from the current literature by the instructor will be analyzed. Assembly language coding problems will be assigned. *Prereq.* 03.470 or 03.670.
- 03.477 Control Engineering I** (4 cl., 4 q.h.) (Day Curriculum)
Analysis of linear servomechanisms under both transient and steady-state conditions; signal flow graphs; Laplace transforms used in the formulation of block diagrams and transfer function. *Prereq.* 03.454 or 03.654 and 10.422 or 10.622.
- 03.478 Control Engineering II** (4 cl., 4 q.h.) (Day Curriculum)
System stability; root locus techniques; treatment of Nyquist criteria and Bode diagram methods for systems evaluation. *Prereq.* 03.477 or 03.677.
- 03.490 Optical Instrumentation** (4 cl., 4 q.h.) (Day Curriculum)
Telescopes, microscopes, etc., as optical system components. Includes magnification, aberrations, resolution criteria, photometry. Compatibility of system components and optimization of systems. The basic nonimage forming systems used for analysis control and metrology. *Prereq.* 10.408 or 10.608, and 11.419 or 11.619.
- 03.498 Special Problems In Electrical Engineering Technology** (2 q.h.)
Theoretical or experimental work under individual faculty supervision. *Prereq.* Consent of department chairman.
- 03.499 Special Problems in Electrical Engineering Technology** (4 q.h.)
Theoretical or experimental work under individual faculty supervision. *Prereq.* Consent of department chairman.
- 03.531 Digital Signal Processing 1** (2 cl., 2 q.h.)
Introduction to digital signal processing discussing sampling, transform and discrete Fourier transform. *Prereq.* 03.363, 09.353.
- 03.532 Digital Signal Processing 2** (2 cl., 2 q.h.)
Discrete systems are taken up with a comparison of continuous and digital filter design. *Prereq.* 03.531.
- 03.533 Digital Signal Processing 3** (2 cl., 2 q.h.)
Frequency domain design is covered with linear phase FIR filters, fast Fourier transforms, continuing with convolution and correlation. *Prereq.* 03.352.
- 03.598 Special Problems in Electrical Engineering Technology** (2 q.h.)
Theoretical or experimental work under individual faculty supervision. *Prereq.* Consent of department chairman.

03.599 Special Problems in Electrical Engineering Technology (4 cl., 4 q.h.)

Theoretical or experimental work under individual faculty supervision. *Prereq.* *Consent of department chairman.*

03.610 Electrical Measurements (4 cl., 4 q.h.)

Standards of measurements, dimensional analysis, errors and measurement of dispersed data, discrete and continuous variables, binomial distribution, normal distribution, guaranteed error, methods of resistance measurements, digital voltmeters and analog to digital conversion, voltage references, potentiometers and a.c. bridges. *Prereq.* 03.453 or 03.653.

03.611 Electronics I (4 cl., 4 q.h.)

Semiconductor diodes and applications, transistor biasing techniques, graphical analysis of basic amplifiers, d.c. and a.c. load lines. *Prereq.* 03.452 or 03.652.

03.612 Electronics II (4 cl., 4 q.h.)

Small-signal, low-frequency transistor models, gains and impedances at midband, frequency effects in transistor circuits, multistage circuits, transistors used as current sources. *Prereq.* 03.411 or 03.611.

03.613 Electronics III (4 cl., 4 q.h.)

Review of Bode plots, transistor circuits at low and high frequencies, feedback, operational amplifiers, differential amplifiers, applications. *Prereq.* 03.412 or 03.612.

03.614 Pulse & Digital I (4 cl., 4 q.h.)

Switching characteristics of semiconductor devices; wave generation and shaping using combinations of passive and integrated circuit components; comparators, hysteresis, and the dual ramp analog to digital converter-voltmeter circuits; voltage to frequency conversion. *Prereq.* 03.411 or 03.611.

03.615 Pulse & Digital II (4 cl., 4 q.h.)

Digital operations; logic statements and theorems; minimization of logic functions; logic gates and the characteristics of the integrated logic families; flip-flops counters and registers; introduction to sequential circuit design; sample and hold circuits; analog to digital conversion. *Prereq.* 03.414 or 03.614.

03.617 Principles of Communication Systems I (4 cl., 4 q.h.)

Signal analysis using Fourier methods; noise in communication systems; frequency selective amplifiers, including wideband; transistor power amplifiers AF and RF; oscillators; signal sources, and applications. *Prereq.* 03.613 or 03.413.

03.618 Principles of Communication Systems II (4 cl., 4 q.h.)

Basic theory of amplitude, frequency, phase and pulse code modulated systems; analysis of modulating and demodulating circuits; carrier systems using SSB; system block and level diagrams; logic control circuits in communication systems; modems. *Prereq.* 03.617 or 03.417.

03.619 Principles of Communication Systems III (4 cl., 4 q.h.)

Fundamentals of digital communications; sampling requirements; analog to digital conversion methods; system capacity and bandwidth; comparison of practical digital systems PAM, PCM, PFM, PWM; time and frequency division multiplexing; data decoding; selected examples from telemetry and computer links. *Prereq.* 03.618 or 03.418.

124 / DESCRIPTION OF COURSES

03.620 Electricity and Electronics I (4 cl., 4 q.h.)

Introduction to circuit analysis, resistive networks, periodic excitation function, steady state a-c circuits; the physical foundations of electronics and the physical operation of electronic devices. *Prereq.* 10.620 or 10.420 and 11.619 or 11.419.

03.621 Electricity and Electronics II (4 cl., 4 q.h.)

Single-stage electronic circuits, magnetic circuits and transformers, electro-mechanical energy conversion, d-c machines, a-c machines. *Prereq.* 03.620 or 03.420.

03.623 Electronics Laboratory (3 lab., 2 q.h.)

Experiments dealing with laboratory equipment (meters and oscilloscopes) techniques; junction and field-effect transistor characteristics; vacuum and semiconductor diodes; power supplies, including the regulated type; silicon controlled rectifiers; resistance-coupled amplifiers using transistors, including feedback methods. *Prereq.* 03.612 or 03.412, or concurrently.

03.624 Circuits Laboratory I (3 lab., 2 q.h.)

Experimentation in electronic circuit theory utilizing various measurement techniques. Instrumentation verification of circuit theorems; response of circuits to steps and impulses; oscilloscope theory and applications. *Prereq.* 03.651 or 03.451.

03.625 Circuits Laboratory II (3 lab., 2 q.h.)

Further experimentation in electrical circuits and measurement techniques. Experiments include response of circuits to steps and impulses, nonlinear devices, terminal characteristics of active devices, log modulus plots, network parameters and synthesis. Fourier analysis and synthesis. *Prereq.* 03.624 or 03.424.

03.627 Advanced Electronics Laboratory I (3 lab., 2 q.h.)

Experiments dealing with the use of oscilloscopes, the examination of transistor audio amplifiers, push-pull amplifiers, drivers, pulse and video amplifiers, transients and wave-shaping circuits, audio frequency oscillators, and the study of operational amplifiers. *Prereq.* 03.623 or 03.423.

03.628 Advanced Electronics Laboratory II (3 lab., 2 q.h.)

Experiments dealing with the modulation of a class C amplifier, the diode detector, basic timing circuits, RF and crystal oscillators, astable multivibrators, logic gates, flip-flops, binary adders, registers and counters; active filters, frequency modulation detectors, and analog-to-digital and digital-to-analog conversion. *Prereq.* 03.627 or 03.427.

03.629 Advanced Electronics Laboratory III (3 lab., 2 q.h.)

Spectral studies of FM and PM waves, amplitude limiters; the balanced modulators and single sideband generators; integrated circuit timers and monolithic random access memory; monolithic phase-locked loop as well as a series of microwave experiments and a series of digital experiments. *Prereq.* 03.628 or 03.428.

03.630 Energy Conversion (4 cl., 4 q.h.)

Generalized theory of rotating energy conversion devices; steady-state operation of the multiply-excited direct-current machine; control of speed; special machines; transformers; steady-state considerations of induction and synchronous machines; generalized machine and circuit model; Laplace transform techniques applied to the analysis of dynamic operating modes of rotating machines. *Prereq.* 03.652 or 03.452 and 10.622 or 10.422.

03.637 Distributed Systems (4 cl., 4 q.h.)

Radiation, transmission, and reception of electromagnetic waves; distributed-line constants and traveling waves of transmission lines; differential equations of the uniform line. *Prereq.* 10.622 or 10.422 and 11.619 or 11.419.

03.651 Circuits Analysis I (4 cl., 4 q.h.)

Ohm's law, Kirchhoff's current and voltage laws, equivalent resistances and sources, mesh and nodal analysis, network theorems, two-port networks and power relations—all with respect to direct currents; energy storage, singularity functions, responses of R, L, and C elements to singularities. *Prereq.* 10.620 or 10.420 and 11.619 or 11.419.

03.652 Circuits Analysis II (4 cl., 4 q.h.)

Complex algebra, phasors, frequency domain, mutual inductance, transformers, steady-state a-c theory, driving point and transfer impedances, power and energy in a-c circuits; Laplace transforms; partial fraction expansion; Laplace transform techniques applied to the solution of RLC networks. *Prereq.* 03.651 or 03.451.

03.653 Circuits Analysis III (4 cl., 4 q.h.)

Application of differential equations to the solutions of linear, time-invariant electrical networks; introduction to singularity functions, convolution, and time domain transient analysis; network topology and duality; introduction to the methods of transformation calculus and complex frequency concepts. *Prereq.* 03.652 or 03.452.

03.654 Circuits Analysis IV (4 cl., 4 q.h.)

Signal analysis in the frequency domain; Fourier series; Fourier and Laplace transform methods; a varied selection of circuit problems is solved using Laplace transforms and related theorems. *Prereq.* 03.653 or 03.453.

03.662 Basic Power Systems I (4 cl., 4 q.h.)

Consideration of power transmission lines; line constants; current voltage and power relations; introduction to electric-power distribution loads, feeders, and substations; application of matrices. *Prereq.* 03.654 or 03.454.

03.663 Basic Power Systems II (4 cl., 4 q.h.)

Consideration of symmetrical and unsymmetrical faults; protective devices—application and coordination; power flow in electric circuits; steady-state power limitations of systems; voltage regulation theory and application. *Prereq.* 03.662 or 03.462.

03.664 Basic Power Systems III (4 cl., 4 q.h.)

Computer applications to power systems with emphasis on load-flow studies; basic ideas of systems planning, short-circuit studies and system stability. *Prereq.* 03.663 or 03.463.

03.670 Digital Computers I (4 cl., 4 q.h.)

Introduction to the field of digital computer design. Topics include general computer organization, number systems and number representations, design characteristics of major computer units. Boolean Algebra applications to computer design. *Prereq.* 03.611 or 03.411.

03.671 Digital Computers II (4 cl., 4 q.h.)

Examination of microprocessor architecture and organization. Study of the machine language and assembly coding of an industry-accepted microprocessor. A suitable topic selected from the current literature by the instructor will be analyzed. Assembly language coding problems will be assigned. *Prereq.* 03.670 or 03.470.

03.677 Control Engineering I (4 cl., 4 q.h.)

Analysis of linear servomechanisms under both transient and steady-state conditions; signal flow graphs; Laplace transforms used in the formulation of block diagrams and transfer function. *Prereq.* 03.654 or 03.454 and 10.622 or 10.422.

03.678 Control Engineering II (4 cl., 4 q.h.)

System stability; root locus techniques; treatment of Nyquist criteria and Bode diagram methods for systems evaluation. *Prereq.* 03.677 or 03.477.

03.690 Optical Instrumentation (4 cl., 4 q.h.)

Telescopes, microscopes, etc., as optical system components. Includes magnification, aberrations, resolution criteria, photometry. Compatibility of system components and optimization of systems. The basic nonimage forming systems used for analysis control and metrology. *Prereq.* 10.608 and 10.408 or 11.619 or 11.419.

CHEMICAL ENGINEERING TECHNOLOGY

04.381 Nuclear Technology I (2 cl., 2 q.h.)

Atomic and nuclear structure; discovery and nature of radioactivity; nuclear instrumentation for particle detection, monitoring, and experimentation; supplementary laboratory experiments. *Prereq.* 10.623, 11.619.

04.382 Nuclear Technology II (2 cl., 2 q.h.)

Nuclear reactions and energy; induced nuclear transformations; neutron properties; radiological safety—the hazards, problems, and protection; applications of radionuclides; supplementary laboratory experiments. *Prereq.* 04.381.

04.383 Nuclear Technology III (2 cl., 2 q.h.)

The fission process and its applications; nuclear reactors—their classification, design, and application; nuclear fuel processing; radioactive waste disposal; supplementary laboratory experiments. *Prereq.* 04.382.

04.481 Nuclear Technology (4 cl., 4 q.h.)

(Day Curriculum)

Atomic and nuclear structure; discovery and nature of radioactivity; nuclear reactions and energy; induced nuclear transformation; neutron properties; nuclear instrumentation for particle detection, monitoring, and experimentation; the fission process and its applications; nuclear reactors—their classification, design, and application; supplementary laboratory experiments. *Prereq.* 10.422, 11.619.

INDUSTRIAL ENGINEERING TECHNOLOGY

05.660 Engineering Economy I (4 cl., 4 q.h.)

Fundamental accounting concepts and familiarization with terminology. Assets, liability, net worth. Analysis of income statement and balance sheet. Flow of funds in a firm. Sources of capital-equity, borrowed, retained earnings, depreciation and depreciation accounting, taxes. Cost of capital, time value of money, equivalence, cash flow of diagrams and tables. Development of cash flows for alternative capital expenditures, analytical methods of engineering economy, including present worth, annual cost, and rate of return. Incremental rate of return, breakeven analysis. Retirement and replacement.

05.582 Industrial Technology I (2 cl., 2 q.h.)

Concepts of methods analysis and work simplification, use of man-machine charts, principles of motion economy, human considerations in designing man-machine systems.

05.583 Industrial Technology II (2 cl., 2 q.h.)

Work measurement, techniques of measurement to include stop watch, micromotion, memomotion, work sampling and predetermined systems. Development of standard data. Establishment of standards, fatigue and delay allowances, rating techniques, incentive plans. *Prereq.* 05.582.

05.590 Engineering Probability and Statistics I (2 cl., 2 q.h.)

Algebra of events and sets. Probability measure, laws of probability. Independence, conditional probability. Random variables, discrete and continuous. Properties of random variables, including density functions, expectations, variance. *Prereq.* 10.323.

05.591 Engineering Probability and Statistics II (2 cl., 2 q.h.)

Sampling statistics. Estimation of parameters of random variables. Point and interval estimation. Hypothesis testing. Simple and composite hypothesis. One-sided and two-sided tests. Tests of measures of variances. Normal, standard deviation, F , X^2 . *Prereq.* 05.590.

COMPUTER TECHNOLOGY

06.400 Computer Programming for Engineering Technology (4 cl., 4 q.h.)

(Day Curriculum)

Introduction to the use of computers in the solution of problems using FORTRAN on interactive terminals. Students write and run programs to compute sequences, averages, etc. Other capabilities of the FORTRAN language, including DO loops, subscripted variables, and alphanumeric manipulation, matrix algebra, and numerical methods. *Prereq.* 10.408 or concurrently.

06.600 Computer Programming for Engineering Technology (4 cl., 4 q.h.)

Introduction to the use of computers in the solution of problems using FORTRAN on interactive terminals. Students write and run programs to compute sequences, averages, etc. Other capabilities of the FORTRAN language, including DO loops, subscripted variables, and alphanumeric manipulation, matrix algebra, and numerical methods. *Prereq.* 10.608 or concurrently.

Note: Students at suburban campuses will find it necessary periodically to come to the Boston Campus Computation Center to run their homework problems.

06.601 FORTRAN Engineering Computation (4 cl., 4 q.h.)

Professional methods for solving engineering problems with FORTRAN. Students will write and run programs using the University's computer. Topics include: subprograms, scientific software packages, solution of equations, data storage, reduction and display. *Prereq.* 06.600 or 09.353.

06.605 Introduction to Programming (4 cl., 4 q.h.)

A high-level structured language will be taught and used as a vehicle for implementing programs. Students will write and run programs using N.U.'s computer. Topics: using N.U.'s computer, flow charting, program construction, computations involving maxima and minima, arrays, simple recursion, subroutines.

06.610 FORTRAN (4 cl., 4 q.h.)

This important scientific language will be taught with engineering applications. Students will write and run FORTRAN programs using N.U.'s computer. Topics: arithmetic replacement, input, output, control and specification statements, looping, arrays, functions and subroutines. *Prereq.* 06.605 or equiv.

06.620 COBOL (4 cl., 4 q.h.)

This important business language will be taught with general applications. Students will write and run COBOL programs using N.U.'s computer. Topics: divisions, names, rules, picture clauses, verbs, input/output instructions, levels, working storage, arithmetic, corresponding, accept, display, compute, copy, update logic, table logic, redefines, search, inline, and COBOL sorts. *Prereq.* 06.605 or equiv.

06.630 Nonnumerical Algorithms (4 cl., 4 q.h.)

Data; structures, storage, manipulation, and retrieval methods. Students will write and run data manipulation programs using N.U.'s computer. Topics: stacks, queues, lists, trees, heaps, sets, graphs, hashing, searching, sorting, key processing, relational models. *Prereq.* 06.605.

06.635 Numerical Algorithms (4 cl., 4 q.h.)

Computer methods for solving mathematical problems. Students will write and run application programs using N.U.'s computer. Topics: deterministic vs. stochastic methods, random number generators, iterative vs. noniterative solutions, maxima and minima in 2 and 3 variables, curve fitting in 2 and 3 variables, integrals, trapezoidal and Simpsons rules, slopes, difference equations in 2 and 3 variables, vector and matrix algebra, simultaneous linear equations, nonlinear equations, permutations, and combinations. *Prereq.* 06.610 or equiv.

06.640 Modern Programming Techniques (4 cl., 4 q.h.)

Structured methods for developing complex computer programs. Students will develop and write sections of complex programs. Students will run programs on N.U.'s computer. Topics: top down design, hierarchy diagrams, HIPO charts, composite design, structured analysis, team programming. *Prereq.* 06.605.

06.645 Assembly Language (4 cl., 4 q.h.)

A typical microprocessor assembly language will be taught. Students will write and run homework problems using a microprocessor simulator package implemented on N.U.'s computer. Topics: binary arithmetic, instruction sets, addressing modes, code conversion, subroutines, macros, I/O. *Prereq.* 06.605.

06.650 Basic Computer Organization (4 cl., 4 q.h.)

Fundamental aspects of basic computer components. Topics: the functions and general operating characteristics of CPU's, primary/secondary and mass memory, controllers, printers/card readers/terminals. What an operating system does, scheduling, monitoring, spooling, paging, system programs, virtual memory, multiprogramming, multiprocessing.
Prereq. 06.605.

06.651 Advanced Computer Organization (4 cl., 4 q.h.)

The operating and performance characteristics of complex and special purpose components. Topics: how an operating system works, memory hierarchies, fiber optics, bubble memory, mass storage, computer networks, distributed processing, data flow, cache memory, associative memory, special purpose/parallel processors, system performance measures. *Prereq.* 06.650.

06.655 Micro Peripheral Hardware (4 cl., 4 q.h.)

The elements of microprocessor peripheral hardware and its interfacing. Students will configure microprocessor systems, using block diagrams showing relevant handshaking signals. Topics: serial and parallel I/O devices, DMA and interrupt control devices, bus arbitration, memory management units, counter timers as extensions of basic CPU functions. *Prereq.* 06.675.

06.656 Complex Peripheral Hardware (4 cl., 4 q.h.)

The interfacing and implementation of special purpose hardware. Students will configure systems, using block diagrams showing relevant handshaking signals. Topics: virtual memory, rotating media, printers, terminals, bus extension concepts, co-processors.
Prereq. 06.655.

06.660 Industry Software (4 cl., 4 q.h.)

A survey of current commercial software packages and methods. Students will exercise commercial packages implemented on N.U.'s computer where applicable. Topics: specific packages and methods which vary from year to year to maintain currency. They will be drawn from the following general categories: data base management, scientific and statistical analysis, security and privacy, software assurance, and documentation.
Prereq. 06.651, 06.610.

06.665 Industry Hardware (4 cl., 4 q.h.)

A survey of the latest industrial developments and trends in computer hardware. Conducted as a seminar. *Prereq.* 06.656.

06.668 Semiconductor Logic (4 cl., 4 q.h.)

A detailed analysis of the bipolar and MOS transistors in saturated and cutoff conditions. Implementation of these concepts to form basic logic and decision-making circuits. Students will convert logical expressions into hardware configuration representations. Topics: Ebers-Moll modeling, PMOS, NMOS, CMOS construction, logic families. *Prereq.* 03.652.

06.669 Computer Logic (4 cl., 4 q.h.)

An introduction to the hardware building blocks of general computers. Students will specify configurations of lower level components to achieve composite logical functions, e.g., construct a register from NAND gates. Topics: gates, flipflops, registers, decoders, ALU's, memory arrays. *Prereq.* 06.668.

06.670 Introduction to CPU Hardware (4 cl., 4 q.h.)

The internal operation of a microprocessor CPU. A black box approach is used. Students purchase and keep individual single board computers for doing homework and simulation. Topics: registers and timing control, programmable gate arrays, array processors as CPU models. *Prereq.* 06.645 or equiv.

06.675 CPU Hardware Architecture (4 cl., 4 q.h.)

The performance characteristics of commercially available CPU's. Students will write code for 4 bit through 32 bit processors. Topics: the characteristics of 4004, 4008, 8080, Z80, Z8000, 8086, 1802, F8, and 6800 processors, and how to use one processor in place of another. Note: the list of processors examined may vary from year to year to maintain currency. *Prereq.* 06.670.

06.680 Data Communication Methods (4 cl., 4 q.h.)

Functional and operational aspects of data communication devices and software. A black box approach will be used. Topics: modems, control units, multiplexers, concentrators, front end processors, synchronous/asynchronous/half duplex/full duplex codes and procedures, Bisynch/SDLE/HDLC, BYTE and BIT protocols, error checking, point to point/multidrop/STAR/MESH/CLUSTER networks. *Prereq.* 06.610.

06.681 Operating Systems (4 cl., 4 q.h.)

The basic principles of operating system implementation. Students write and run programs to exercise elements of the University's operating system when applicable. Topics: resource, memory, processor and device management commands and strategies, I/O programming, swapping, overlays, jobs and process scheduling, and other operating systems. *Prereq.* 06.651.

06.682 Computer Graphics Programming (4 cl., 4 q.h.)

Students are introduced to generalized techniques for the computer plotting of 2 and 3 dimensional shapes. Students write and run programs using the University's computer and digital plotter. Topics: 2D transforms, 3D to 2D transforms, 3D transforms, surface representation, shading, characters, curve fitting, graphic data structures. *Prereq.* 06.610.

06.683 Data Bases (4 cl., 4 q.h.)

An introduction to data base organization structure and management. Students write and run programs exemplifying techniques developed in class on the University's computer. Topics: access methods, attributes, indices, keys, querying, searching and matching, file sets, inverted file sets, normal forms, random access. *Prereq.* 06.630.

06.684 Large System Assembly Languages (4 cl., 4 q.h.)

Typical large computer system assembly languages. Students will write and run illustrative programs on the University's computer. Topics: edit and translate instructions, macro writing, program sectioning, linking, data representation, addressing, instruction formats in BAL and VAX-11 assembler languages. *Prereq.* 06.645.

06.685 Introduction to Simulation Programming (4 cl., 4 q.h.)

Computer methods for solving simulated phenomena. Students will write and run programs implementing simulations specified by instructor. Students will not be responsible for the validity or evaluation of models except in simple cases. Topics: simple queues, multiserver queues, priorities including first in first out, last in last out and time aging of data, simple frequency distributions, use of SIMULA, GPSS, and Standard Subroutine Library Routines. *Prereq.* 06.635.

06.686 Device System Hardware (4 cl., 4 q.h.)

A study of the principal hardware capabilities and current trends in micro computer level systems. Included are both single users and network oriented systems. *Prereq.* 06.675.

06.687 Bit Slice Micro Computers (4 cl., 4 q.h.)

The epitome of hardware flexibility is represented by the bit slice CPU. Demonstrates the basic design ground rules common to this style of hardware design. *Prereq.* 06.655.

06.688 Micro Controllers (4 cl., 4 q.h.)

The commercial segment of micro computers has been satisfied by a variety of single chip 4 bit micros controllers. A detailed contrast/comparison will be done on several of these devices, including the IMS-1000, S2000, COPS, and PPS-4. *Prereq.* 06.670.

06.689 Single Chip Microprocessors (4 cl., 4 q.h.)

When small 8 bit intelligent devices are rewired in high volume, the single chip micro-processor in the form of the 3870, 8048, Z8, and others come into play. An understanding of the hardware limitations of a single chip system presents the basis for this subject material. *Prereq.* 06.670.

06.690 Special Problems in Computer Technology (4 cl., 4 q.h.)

Theoretical or experimental work under individual faculty supervision. *Prereq.* Consent of department chairman.

ENGINEERING GRAPHICS

09.314 Engineering Design I (Kinematics) (1 cl., 2 lab., 2 q.h.)

Translatory and rotary motion involving mechanisms through graphical vector and mathematical analysis of displacement and velocity; some redesign of existing mechanisms; simple, compound, reverted, and epicyclic gear trains. *Prereq.* 09.313, 11.317.

09.315 Engineering Design II (1 cl., 2 lab., 2 q.h.)

Drawings and specifications for the production and precision machining of castings, forging, weldments, etc.; discussion of design components. *Prereq.* 09.314.

09.316 Engineering Design III (1 cl., 2 lab., 2 q.h.)

Introduction to design through graphical analysis of cam and follower motions and other mechanisms; creativity and design processes through case studies and original projects requiring oral presentation of student's involvement in both synthesis and innovative activities. *Prereq.* 09.315.

09.461 Engineering Design Graphics I (2 cl., 2 q.h.) (Day Curriculum)

Introduction to engineering drawing; orthographic projection and primary auxiliary views; reading and interpreting of multiview drawings; isometric and oblique pictorial representation. An introduction to the decision-making process for engineering design.

09.462 Engineering Design Graphics II (2 cl., 2 q.h.) (Day Curriculum)

Emphasis on engineering drawings required to support engineering design, including standard conventions, dimensioning, and basic production processes; shop detail drawings are covered; exercise in design processes is given through selected projects and case studies. *Prereq.* 09.461.

- 09.463 Engineering Design Graphics III** (2 cl., 2 q.h.) (Day Curriculum)
Greater involvement in design by examination of many commonly used components; case studies of large systems discussed in class; advanced design projects assigned. *Prereq.* 09.462.
- 09.464 Engineering Design Graphics IV** (4 cl., 4 q.h.) (Day Curriculum)
Graphical analysis of kinematic elements; displacement, locus generators, velocity vectors, and sliding motion; simple, compound, and reverted gear trains; acceleration analysis of mechanisms such as cams and linkages; functions, scales and nomographs; introduction to self-correcting (feedback) systems. *Prereq.* 09.463.
- 09.470 Engineering Graphics I** (4 cl., 4 q.h.) (Day Curriculum)
The study of concepts and the development of skills to present and to analyze objects and systems used in design through the principles of graphical geometric constructions, orthographic projections (multi-view, two-dimensional drawings), and the design process. Assignments will include the layout of drawings on the paper, solutions to graphical problems concerning objects and systems, and complete solutions to short problems using the design process.
- 09.471 Engineering Graphics II** (4 cl., 4 q.h.) (Day Curriculum)
Continuation of the study of concepts and the development of skills to present and to analyze objects and systems used in design, including dimensioning, sectioning, threads, fasteners, assembly and detail drawings, as well as the design process. Assignments will require solutions to graphical problems that will require the studied graphical material and a progress report leading to the solution of a design problem. *Prereq.* 09.470.
- 09.472 Electrical Engineering Graphics** (4 cl., 4 q.h.) (Day Curriculum)
Introduction to electronic graphics, including symbols, schematics, block and logic diagrams, production and cable drawings, military standards. A study of single- and double-sided printed circuit layout, integrated circuits, electro-mechanical designs, wiring, and interconnection diagrams; graphical data presentation. *Prereq.* 09.470.
- 09.664 Engineering Design Graphics IV** (4 cl., 4 q.h.)
Graphical analysis of kinematic elements; displacement, locus generators, velocity vectors, and sliding motion; simple, compound, and reverted gear trains; acceleration analysis of mechanisms such as cams and linkages; functions, scales and nomographs; introduction to self-correcting (feedback) systems. *Prereq.* 09.671.
- 09.670 Engineering Graphics I** (4 cl., 4 q.h.)
Introduction to engineering drawing by geometric constructions, charting, and graphs. Orthographic projection, including reading, sketching, and auxiliary views. Axonometric drawing and elements of descriptive geometry. Section and conventions.
- 09.671 Engineering Graphics II** (4 cl., 4 q.h.)
Determination of design project. Intersections and development. Manufacturing processes and dimensioning, including true position tolerancing. Threads and fasteners. Making and reading assembly drawing. Topographical and earth work drawings as applicable to civil engineers. Case studies of engineering problems and introduction to computer-aided design. Presentation of design project. *Prereq.* 09.611.

09.672 Electrical Engineering Graphics (4 cl., 4 q.h.)

Introduction to electronic graphics, including symbols, schematics, block and logic diagrams, production and cable drawings, military standards. A study of single- and double-sided printed circuit layout, integrated circuits, electro-mechanical designs, wiring, and interconnection diagrams; graphical data presentation. *Prereq.* 09.670.

MATHEMATICS**10.303 Introduction to Mathematics**

(Day Curriculum)

An accelerated combination of 10.381 and 10.382.

10.316 Probability and Statistics I (2 cl., 2 q.h.)

Basic tools, e.g., sets, permutations, and combinations; probability and applications.

Prereq. 10.608, 10.329, or 10.335.

10.317 Probability and Statistics II (2 cl., 2 q.h.)

Descriptive statistics; frequency distributions and probability density functions; normal and other distributions. *Prereq.* 10.316.

10.318 Probability and Statistics III (2 cl., 2 q.h.)

Bivariate distributions, correlation; statistical inference and estimation; regression.

Prereq. 10.317.

10.320 Calculus I (4 cl., 4 q.h.)

Plane analytic geometry; differentiation of algebraic functions; rate, motion, maximum and minimum problems; derivations of higher order; curve sketching; basics in functions, limits, and continuity. *Prereq.* 10.608.

10.323 Calculus IV (2 cl., 2 q.h.)

Vectors in the plane; vectors in three-dimensional space; functions of more than one variable; partial differentiation; multiple integration; infinite series; Taylor's and Maclaurin's Formula. *Prereq.* 10.322.

10.324 Differential Equations I (2 cl., 2 q.h.)

Ordinary differential equations—standard types of the first order; some applications; special differential equations of the second order. *Prereq.* 10.323.

10.325 Differential Equations II (2 cl., 2 q.h.)

Linear differential equations with constant coefficients, homogeneous and nonhomogeneous; variation of parameters, simultaneous differential equations; Laplace transform.

Prereq. 10.324.

10.326 Differential Equations III (2 cl., 2 q.h.)

Continuation of Laplace transform; series and solution of differential equations by series; Fourier series; orthogonal functions. *Prereq.* 10.325.

10.351 Advanced Mathematics I (Numerical Analysis) (2 cl., 2 q.h.)

Basic methods of numerical analysis—roots by iteration; approximating polynomials and interpolation; least squares fitting; numerical integration; approximate solution of ordinary differential equations—problems employing the electronic computer. *Prereq.* 06.601 or 06.610 and 10.623.

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10.352 Advanced Mathematics II (2 cl., 2 q.h.)

Introduction to partial differential equations, boundary-value problems, Sturm-Liouville systems. *Prereq.* 10.351.

10.353 Advanced Mathematics III

Special topics in analysis. *Prereq.* 10.352.

10.361 Modern Algebra I (2 cl., 2 q.h.)

Sets; binary operations; mappings; rings, integers, fields; reals, bases for computer applications; Euclidean algorithm; primes. *Prereq.* 10.608, 10.329, or 10.335.

10.362 Modern Algebra II (2 cl., 2 q.h.)

Field of complex numbers; groups; subgroups; polynomial rings; homomorphisms; isomorphisms, ideals. *Prereq.* 10.361.

10.363 Modern Algebra III (2 cl., 2 q.h.)

Vector spaces; linear transformations; dependence, independence; dimension applications to engineering, science, and business. *Prereq.* 10.362.

10.364 Modern Applied Algebra (4 cl., 4 q.h.)

Introduction to the language of abstract algebra to the following topics: graphs, finite state machines, programming languages, Boolean Algebra, lattices, coding for communication channels, and radar; look at algebraic theory of linear systems. *Prereq.* 10.361, 10.362, and 10.363.

10.404 Pre-Calculus Mathematics (4 cl., 4 q.h.)

Treats those topics in algebra, trigonometry, and analytical geometry which will be of greatest value to the beginning calculus student.

10.405 Theory of Gambling (2 cl., 2 q.h.)

A general interest course in various types of gambling games. A short review of the topics of permutations, combinations, and probability as they apply to some of the problems of gambling. Emphasis on the casino game of craps, roulette, chuck-a-luck, slot-machines, keno, and blackjack, with an analysis of the players' expectations in each of these games. Winning strategies and card-counting methods in casino blackjack. Some problems on card games such as poker and acey-deucey, the law of averages and gamblers' ruin.

10.407 College Algebra and Trigonometry I (4 cl., 4 q.h.) (Day Curriculum)

Fundamental algebraic operations; complex numbers; radicals and exponents; functions; linear and quadratic equations; irrational equations; inequalities; variation; roots of polynomial equations.

10.408 College Algebra and Trigonometry II (4 cl., 4 q.h.) (Day Curriculum)

Logarithms; trigonometric functions of angles in degrees and radians; trigonometric identities and equations; right triangles; oblique triangles; complex numbers in trigonometric form; systems of equations; determinants. *Prereq.* 10.407 or 10.607.

10.420 Calculus I (4 cl., 4 q.h.) (Day Curriculum)

Plane analytic geometry; differentiation of algebraic functions; rate, motion, maximum and minimum problems; derivations of higher order; curve sketching; basics in functions, limits, and continuity. *Prereq.* 10.408 or 10.608.

10.421 Calculus—A (4 cl., 4 q.h.)

(Day Curriculum)

Applications of derivatives to curvesketching; antidifferentiation; the definite integral, with applications; calculus of nonalgebraic functions—logarithmic, exponential, and trigonometric; calculus of inverse trigonometric functions; techniques of integration; indeterminate forms; L'Hospital's rule. *Prereq.* 10.420 or 10.620.

10.422 Calculus—B (3 cl., 4 q.h.)

(Day Curriculum)

Calculus of functions of several variables; partial differentiation; multiple integrals; infinite series; vector analysis; polar coordinates; vectors in a plane. *Prereq.* 10.421 or 10.621.

10.423 Differential Equations (4 cl., 4 q.h.)

(Day Curriculum)

Ordinary differential equations—standard types of the first order; linear differential equations, especially with constant coefficients; Laplace transforms; series solutions of differential equations; Fourier series; and orthogonal functions. *Prereq.* 10.422 or 10.622.

10.607 College Algebra I (4 cl., 4 q.h.)

Fundamental algebraic operations; complex numbers; radicals and exponents; functions; linear and quadratic equations; irrational equations; inequalities; variation; roots of polynomial equations. *Prereq.* *Math Placement Test* or 10.682.

10.608 Introduction to Calculus (4 cl., 4 q.h.)

Logarithms; trigonometric functions of angles in degrees and radians; trigonometric identities and equations; right triangles; oblique triangles; complex numbers in trigonometric form; systems of equations; determinants. *Prereq.* 10.407 or 10.607.

10.620 Calculus I (4 cl., 4 q.h.)

Plane analytic geometry; differentiation of algebraic functions; rate, motion, maximum and minimum problems; deviations of higher order; curve sketching; basics in functions, limits, and continuity. *Prereq.* 10.408 or 10.608.

10.621 Calculus—A (4 cl., 4 q.h.)

Applications of derivatives to curvesketching; antidifferentiation; the definite integral, with applications; calculus of nonalgebraic functions—logarithmic, exponential, and trigonometric; calculus of inverse trigonometric functions; techniques of integration; indeterminate forms; L'Hospital's rule. *Prereq.* 10.420 or 10.620.

10.622 Calculus—B (3 cl., 4 q.h.)

Calculus of functions of several variables; partial differentiation; multiple integrals; infinite series; vector analysis; ordinary differential equations—standard types of the first order; some applications; special differential equations of the second order. *Prereq.* 10.421 or 10.621.

10.623 Calculus—C (4 cl., 4 q.h.)

Linear differential equations with constant coefficients, homogeneous and nonhomogeneous; variation of parameters, simultaneous differential equations; Laplace transform; series and solution of differential equations by series; Fourier series; orthogonal functions. *Prereq.* 10.422 or 10.622.

10.627 Mathematics I (3 q.h.)

Sets, number systems, fundamental operations of algebra, exponents, radicals, linear equations. *Prereq.* *Math Placement Test*, or 10.302, or 10.331.

10.628 Mathematics II (3 q.h.)

Fractional equations; inequalities; functions, relations, graphs; quadratic equations; systems of equations; ratio, proportion, variation; logarithms. *Prereq.* 10.627.

10.629 Mathematics III (3 q.h.)

Progressions; introduction to calculus; rates of change, slopes, area under a curve, maximum and minimum problems; elementary matrix algebra. *Prereq.* 10.628.

10.632 Mathematics for Business Management I (3 q.h.)

Topics in mathematics applicable to management. Logic, set theory, probability with applications. Survey of mathematical models, linear models. *Prereq.* 10.629 and 39.313, or equiv.

10.633 Mathematics for Business Management II (3 q.h.)

Linear programming problems, solution by graphing. Matrix algebra, markov chains, directed graph models, mathematics of finance. *Prereq.* 10.632.

10.634 Mathematics for Business Management III (3 q.h.)

Statistical decision theory, utility theory, theory of games, regression-based models. *Prereq.* 10.633.

10.671 Basic Mathematics I (2 cl., 2 q.h.)

This credit cannot be used in the Associate in Engineering, Associate in Science, or the Bachelor of Engineering Technology degree programs.

A review of elementary algebra; algebraic expressions and operations, equations, word problems.

10.672 Basic Mathematics II (2 cl., 2 q.h.)

This credit cannot be used in the Associate in Engineering, Associate in Science, or the Bachelor of Engineering Technology degree programs.

Further review; operations with polynomials, factoring, fractional expressions, word problems. *Prereq.* 10.330.

10.681 Introduction to Mathematics I (4 cl., 4 q.h.)

This credit cannot be used in the Associate in Engineering, Associate in Science, or the Bachelor of Engineering Technology degree programs.

A comprehensive review of high school algebra, including first-degree equations, factoring, fractions, fractional equations, ratio and proportion, word problems, and concepts of plane geometry.

10.682 Introduction to Mathematics II (4 cl., 4 q.h.)

This credit cannot be used in the Associate in Engineering, Associate in Science, or the Bachelor of Engineering Technology degree programs.

Algebraic operations with complex fractions, mixed expressions, square roots, radicals, quadratic equations; simultaneous equations, graphs and fractional zero and negative exponents; the geometry of the right triangle, areas of polygons, circles, and loci problems. *Prereq.* 10.301.

10.683 Applied Mathematics & Statistics (3 q.h.)

The use of mathematics as a guide to concise thinking; the application of mathematical methods to highlight significant data. The use of elementary analytical models to test and evaluate hypotheses. An examination of the role of chance in physical phenomena. The importance of the use of a relevant statistical model. Methods for the selection of a data base. *Prereq.* 10.682 or equiv.

PHYSICS

Courses marked not available in every curriculum. See curricula in Academic Programs of Instruction section for applicable sequence, pp. 65–104.*

11.320 Semiconductor Physics & Devices (4 cl., 4 q.h.)

Properties of atoms and electrons as related to conduction of electricity in solids; energy-band of semiconductors; nature of pn junctions; diode characteristics; electrons and holes; application of diodes; transistor theory, characteristics, construction, and operation; Zener and Avalanche breakdown; Zener specifications and performance; tunnel diode characteristics and parameters; field-effect transistors; photomultipliers and photodiodes; LED's and Liquid-Crystal devices; piezoelectric devices; integrated circuits; electron tube theory. (This is a combination of 11.322 and 11.323.) *Prereq.* 11.619.

11.321 Wave Phenomena (2 cl., 2 q.h.)

Application of fundamental principles of waves to electromagnetic radiation; waves on transmission lines, including the use of Smith Charts; selected topics in radar, TV transmission, citizen band systems, pertaining to electromagnetic wave transmission. *Prereq.* 11.619 or 11.316.

11.322 Semiconductor Physics (2 cl., 2 q.h.)

Properties of atoms and electrons as related to conduction of electricity in solids; energy-band of semiconductors; nature of pn junctions; diode characteristics; electrons and holes; application of diodes; transistor theory, characteristics, construction, and operation. *Prereq.* 11.619.

11.323 Semiconductor Devices (2 cl., 2 q.h.)

Zener and Avalanche breakdown; Zener specifications and performance; tunnel diode characteristics and parameters; field-effect transistors; photomultipliers and photodiodes; LED's and liquid-crystal devices; piezoelectric devices; integrated circuits; electron tube theory. *Prereq.* 11.322.

11.331 Modern Physics I (2 cl., 2 q.h.)

Introduction to theory of relativity; mass and binding energy; photoelectric effect; De Broglie hypothesis; wave-packet of particles; Schrodinger wave equation; Bohr theory of the atom. *Prereq.* 11.606 or 11.619.

11.332 Modern Physics II (2 cl., 2 q.h.)

Quantum theory of hydrogen atom; Pauli's exclusion principle; the Zeeman effect; structure of molecules, Laser theory, semiconductor theory and devices. *Prereq.* 11.331.

11.333 Modern Physics III (2 cl., 2 q.h.)

Properties of nucleus; alpha, beta, and gamma theory; nuclear reactions; fusion and thermonuclear energy; introduction to elementary particles; eightfold way; quarks; and J particles. *Prereq.* 11.332.

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11.417 Physics I (Mechanics) (4 cl., 4 q.h.) (Day Curriculum)
Kinematics and dynamics of particle motion; Newton's laws; projectile and circular motion; conservation laws for momentum and energy; rational motion; simple harmonic motion.
Prereq. 10.407 or concurrently.

11.418 Physics II (Properties of Matter, Heat, Wave Motion, Sound, Light)
(4 cl., 4 q.h.) (Day Curriculum)
Elasticity; density and pressure; temperature; expansion; heat; change of state; heat transfer; vibrating systems; wave motion; properties of sound; properties of light.
Prereq. 11.417.

11.419 Physics III (Electricity, Magnetism) (4 cl., 4 q.h.) (Day Curriculum)
Electrostatics; circuit elements; direct current circuits; magnetism; electromechanical devices; alternating current circuits; electronics; electromagnetic waves. *Prereq.* 11.418.

11.473 Physics Laboratory I (2½ lab., 2 q.h.) (Day Curriculum)
Same laboratory as 11.373 not listed. It is scheduled during the day program.
Prereq. 11.418.

11.474 Physics Laboratory II (2½ lab., 2 q.h.) (Day Curriculum)
Same laboratory as 11.374 not listed. It is scheduled during the day program.
Prereq. 11.473.

***11.604 General Physics I** (2 cl., 2 q.h.)
Survey of Newtonian mechanics; kinematics, and dynamics of particle motion; projectile and circular motion; conservation laws of energy and momentum. *Prereq.* 10.627 or concurrently.

***11.605 General Physics II** (2 cl., 2 q.h.)
Temperature; heat energy; mechanical equivalent of heat; wave motion; sound; Doppler's effect; elasticity and simple harmonic motion; rotational motion; fluids at rest in motion.
Prereq. 11.604.

***11.606 General Physics III** (2 cl., 2 q.h.)
Fundamentals of electricity and magnetism; fields; potential; electric current; inductance; capacitance; electromagnetism; a-c and d-c series circuits; properties of light; simple optical systems. *Prereq.* 11.605.

11.617 Physics I (Mechanics) (4 cl., 4 q.h.)
Vectors and balanced forces; accelerated motion; Newton's laws; projectile motion; work and energy; momentum; angular motion; centripetal force; rotation of rigid bodies; moment of inertia. *Prereq.* 10.407, 10.607 or concurrently.

11.618 Physics II (Properties of Matter, Heat, Wave Motion, Sound, Light)
(4 cl., 4 q.h.)
Elasticity; density and pressure; temperature; the gas laws; heat transfer; thermodynamics; vibratory motion; wave motion; properties of sound; properties of light.
Prereq. 11.417 or 11.617.

11.619 Physics III (Electricity, Magnetism) (4 cl., 4 q.h.)

Electrostatics; circuit elements; direct current circuits; magnetism; electromechanical devices; alternating current circuits; electronics; electromagnetic waves. *Prereq.* 11.418 or 11.618.

11.624 Introductory Survey of Lasers (2 cl., 2 q.h.)

Physical principles and technology will be emphasized. Includes a review of the fundamental concepts of light and spectroscopy, the basic theory of lasers, studies of solid state; atomic, ionic, and molecular gas; organic dye; and semiconductor lasers. Related optics and detection will be discussed. *Prereq.* 11.619.

11.673 Physics Laboratory I (2½ cl., 2 q.h.)

First quarter of a two-quarter physics laboratory. Experiments in mechanics, fluid dynamics, and gas laws. *Prereq.* 11.605, or 11.618, or concurrently.

11.674 Physics Laboratory II (2½ cl., 2 q.h.)

A continuation of 11.673. Experiments in wave motion, optics, and electrical circuits.

11.681 Introductory Physics I (4 cl., 4 q.h.)

This credit cannot be used in the Associate in Engineering, Associate in Science, or the Bachelor of Engineering Technology degree programs.

An introduction to mechanics: units of measurement, vectors, accelerated motion, and Newton's laws of motion. *Prereq.* none.

11.682 Introductory Physics II (4 cl., 4 q.h.)

This credit cannot be used in the Associate in Engineering, Associate in Science, or the Bachelor of Engineering Technology degree programs.

Continuation of mechanics: conservation of energy and momentum. Introduction to elements of heat, thermodynamics, light, and electromagnetism. *Prereq.* 11.681.

CHEMISTRY

Students wishing to elect other chemistry courses should refer to the University College Catalog and petition for approval by the Academic Standing Committee of Lincoln College.

12.407 Modern Chemistry I (Introduction to Inorganic Chemistry)

(2 cl., 2.4 lab., 3 q.h.)

Fundamental ideas of matter and energy, chemical bonding, chemical energy, water and solutions, colloids, ionic reactions, oxidation and reduction, acidity, radioactivity, air and water pollution. All topics discussed from the viewpoint of recent developments. The laboratory deals with experiments related to the lecture material. (Laboratory fee)

12.408 Modern Chemistry II (Introduction to Organic Chemistry)

(2 cl., 2.4 lab., 3 q.h.)

Classes of organic compounds, including hydrocarbons, alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, amines, amides, and carbohydrates, including their relationship with modern biology. The laboratory deals with experiments related to the lecture material. *Prereq.* 12.407 or equiv. (Laboratory fee)

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12.409 Modern Chemistry III (Introduction to the Chemistry of Living Bodies)

(2 cl., 2.4 lab., 3 q.h.)

Includes fats, proteins, enzymes, chemistry of digestion, and the chemical reactions of body fluids. The laboratory deals with experiments related to the lecture material.

Prereq. 12.408 or equiv. (Laboratory fee)

12.415 Biochemistry I (3 cl., 3 q.h.)

The first quarter of a three-quarter sequence. Covers introduction to the biochemistry of the cell, including the occurrence, chemistry, and metabolism of carbohydrates, lipids, proteins, and nucleic acids. *Prereq.* 12.433 or equiv.

12.416 Biochemistry II (3 cl., 3 q.h.)

Continuation of Biochemistry I. *Prereq.* 12.415 or equiv.

12.417 Biochemistry III (3 cl., 3 q.h.)

Continuation of Biochemistry II. *Prereq.* 12.416 or equiv.

12.421 Analytical Chemistry I (2 cl., 2.4 lab., 3 q.h.)

Analytical procedures and techniques. Principles and practice of gravimetric methods of analysis. Laboratory work involves procedures and techniques of gravimetric analysis.

Prereq. 12.456 or equiv. (Laboratory fee)

12.422 Analytical Chemistry II (2 cl., 2.4 lab., 3 q.h.)

Principles and practice of titrimetric methods of analysis. The laboratory work involves the procedures and techniques of volumetric analysis. *Prereq.* 12.421 or equiv. (Laboratory fee)

12.423 Analytical Chemistry III (2 cl., 2.4 lab., 3 q.h.)

Theories of spectrophotometry, chromatography, and selected electroanalytical methods. The laboratory involves instruments and procedures for electrometric and optical methods of chemical analysis. *Prereq.* 12.422 or equiv. (Laboratory fee)

12.431 Organic Chemistry I (2 cl., 4 lab. and disc., 4 q.h.)

Nature of carbon in organic compounds. General principles of structure, nomenclature, preparation, uses, and reactions of aliphatic hydrocarbons: alkanes, alkenes, alkynes, dienes, cycloalkanes. Position and geometric isomerism. Introduction to free radical and ionic mechanisms of reactions. The laboratory deals with the preparation and properties of compounds discussed in lectures. *Prereq.* 12.456 or equiv. (Laboratory fee)

12.432 Organic Chemistry II (2 cl., 4 lab. and disc., 4 q.h.)

Structure of benzene, electrophilic aromatic substitution reactions. General principles of structure, nomenclature, preparation, uses, and reactions of the various types of organic compounds, including: alcohols, alkyl and aryl halides, ethers and epoxides, and carboxylic acids. Optical isomerism and introductory chemical kinetics will be discussed. The laboratory deals with the preparation and properties of compounds discussed.

Prereq. 12.431 or equiv. (Laboratory fee)

12.433 Organic Chemistry III (2 cl., 4 lab. and disc., 4 q.h.)

Continuation of 12.432, with emphasis on the application of chemical conversions to synthetic problems. Functional derivatives of carboxylic acids, sulfonic acids and their derivatives, amines, diazonium compounds, phenols, aldehydes, and ketones. The laboratory deals with the preparation and properties of compounds discussed. *Prereq.* 12.432 or equiv. (Laboratory fee)

12.441 Physical Chemistry I (3 cl., 3 q.h.)

Thermodynamics, thermochemistry, First and Second Laws, entropy and free energy in spontaneous processes. *Prereq.* 10.323, 11.306, and 12.446 or equiv.

12.442 Physical Chemistry II (3 cl., 3 q.h.)

Chemical equilibria, acids and bases, electrochemistry, colligative properties, phase diagrams, thermodynamics of multicomponent systems, kinetic molecular theory.

Prereq. 12.441 or equiv.

12.443 Physical Chemistry III (3 cl., 3 q.h.)

Kinetics, quantum chemistry, photochemistry. *Prereq.* 12.422 or equiv.

12.444 General Chemistry I (2 cl., 2.4 lab, 3 q.h.)

Fundamental concepts: symbols, formulas, equations, atomic weights, and calculations based on equations. Gases, liquids, solutions, and ionization. The laboratory deals with experiments related to the lectures. *Prereq.* 10.327 or equiv., or concurrently. (Not open to those students with credit for 12.311 or 12.314.) (Laboratory fee)

12.445 General Chemistry II (2 cl., 2.4 lab, 3 q.h.)

Atomic structure, bonding, and molecular structure. Oxidation and reduction reactions, equilibrium and kinetics. The laboratory deals with experiments related to the lectures.

Prereq. 12.444 or equiv. (Not open to those students with credit for 12.312 or 12.315.) (Laboratory fee)

12.446 General Chemistry III (2 cl., 2.4 lab, 3 q.h.)

Thermochemistry and electrochemistry. Acids, bases, and solubility product. Nuclear chemistry. Introductory organic chemistry and biochemistry. The laboratory deals with experiments related to the lectures. *Prereq.* 12.445 or equiv. (Not open to those students with credit for 12.313 or 12.316.)

12.451 Instrumental Analysis I (formerly Instrumental and Radiochemistry I)

(3 cl., 3 q.h.)

Basic theory and instruments used in electrochemical analysis. Includes such topics as electrode and cell potentials, potentiometric titrations, direct potentiometry (pH meters and specific ion electrodes), coulometry, polarography, amperometry, electrogravimetry, and conductivity. *Prereq.* 12.423 or equiv. (This course and 12.452 can serve as preparation for certain graduate courses.)

12.452 Instrumental Analysis II (formerly Instrumental and Radiochemistry II)

(3 cl., 3 q.h.)

Basic theory and instruments used in spectrochemical analysis. Includes such topics as electromagnetic spectrum, ultraviolet and visible spectrophotometry, infrared spectrophotometry, X-ray analysis, fluorescence and phosphorescence, emission spectrophotometry, absorption spectrophotometry, and chromatography. *Prereq.* 12.451 or equiv. (This course and 12.451 can serve as preparation for certain graduate courses.)

12.453 Radiochemistry (formerly Instrumental and Radiochemistry III) (3 cl., 3 q.h.)

Radioactivity and nuclear reactions; production and study of nuclear reactions; equations of radioactive decay; nuclear states and radioactive processes; interaction of radiation with matter; radiation detection and measurement; statistics of radioactivity measurements; techniques for the study of radionuclides; tracers in chemical applications; and nuclear energy. *Prereq.* 12.452 or equiv.

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12.460 Chemistry Workshop (1.5 cl., 0 q.h., given twice weekly)

A discussion and problem-solving session which will reinforce and reexamine the material covered in 12.444, 12.445, and 12.446. Content is programmed according to needs of the students, and the classes are small and informal.

BIOLOGY

Students wishing to elect other biology courses should refer to the University College Catalog and petition for approval by the Academic Standing Committee of Lincoln College.

18.407 Gross Anatomy and General Physiology I (3 cl., 3 q.h.)

Fundamental concepts of living organisms; chemical and biological characteristics of cellular metabolism; the skeletal system and its appendages; general nomenclature, anatomical names and terms.

18.408 Gross Anatomy and General Physiology II (3 cl., 3 q.h.)

The systems of the body and the relationships between them; the structure and function of each. *Prereq.* 18.407 or equiv.

18.409 Gross Anatomy and General Physiology III (3 cl., 3 q.h.)

Continuation of the systems of the body and the relationships between them. *Prereq.* 18.408 or equiv.

18.411 Biology I (General) (3 cl., lab., 4 q.h.)

Universal properties and processes of living organisms; cellular composition and cellular activities; inheritance and cellular control. (Laboratory fee)

18.412 Biology II (Animal) (3 cl., 3 lab., 4 q.h.)

Functional anatomy of animal organ systems, their interactions and environmental relationships. *Prereq.* 18.411 or equiv. (Laboratory fee)

18.413 Biology III (Animal) (3 cl., 3 lab., 4 q.h.)

Systematic comparative study of the structure and functions of animals. Diversity of animals considered from the standpoint of evolutionary adaptation. *Prereq.* 18.412 or equiv. (Laboratory fee)

18.421 Microbiology I (2 cl., 3 lab., 3 q.h.)

Morphology and biochemistry of bacteria. *Prereq.* 18.413 or equiv. (Laboratory fee)

18.422 Microbiology II (2 cl., 3 lab., 3 q.h.)

Survey of pathogenic microorganisms. *Prereq.* 18.421 or equiv. (Laboratory fee)

18.423 Microbiology III (2 cl., 3 lab., 3 q.h.)

Biology of the protista; the role of microorganisms in the environment and industry. *Prereq.* 18.422. (Laboratory fee)

18.424 Human Anatomy and Physiology I (2 cl., 2 lab., 3 q.h.)

Introduction to human anatomy; osteology, anatomy of the muscular system, respiratory system, digestive system, the vascular systems, urogenital system. The laboratory includes a study of human bones and cat dissection. *Prereq.* 18.406 or 18.413 or equiv. (Laboratory fee)

18.425 Human Anatomy and Physiology II (2 cl., 2 lab., 3 q.h.)

Principles of physiology and continuation of the study of human anatomy. The laboratory is mainly concerned with muscle physiology. *Prereq.* 18.424 or equiv. (Laboratory fee)

18.426 Human Anatomy and Physiology III (2 cl., 2 lab., 3 q.h.)

Continuation of the principles of physiology. The anatomy and physiology of the nervous system, physiology of the endocrine system. The laboratory deals with physiology of respiration and the physiology of blood. *Prereq.* 18.425 or equiv. (Laboratory fee)

18.461 Ecology I (3 cl., 3 q.h.)

Environmental factors; the soil system; water; the atmosphere; temperature, light, wind, pressure; the physico-chemical factors—CO₂, N, and mineral nutrients; habitat; distribution of plants and animals in the world according to temperature and precipitation. *Prereq.* 18.413 or equiv.

18.462 Ecology II (3 cl., 3 q.h.)

The ecosystem; ecological niche; the producers, consumers, and decomposers; the pond ecosystem, desert ecosystem, forest ecosystem, and sea shore ecosystem; energy cycle and efficiency of energy utilization; mass, weight, and energy pyramids. *Prereq.* 18.461 or equiv.

18.463 Ecology III (3 cl., 3 q.h.)

Population ecology; biotic community; population growth; relations between the species; symbiosis; competition; predation; succession. *Prereq.* 18.462 or equiv.

18.464 Man and His Biosphere I (3 cl., 3 q.h.)

An ecological analysis of the human situation and man's interaction with other organisms; the necessary foundation of biological principles will be presented.

18.465 Man and His Biosphere II (3 cl., 3 q.h.)

A continuation of Man and His Biosphere I. *Prereq.* 18.464 or equiv.

ARTS AND SCIENCES

Students wishing to elect other humanities, social science, and natural science courses should refer to the University College Catalog and petition for approval by the Academic Standing Committee of Lincoln College.

19.301 Psychology I (3 q.h.)

An introductory survey of the historical backgrounds of psychology, psychological measurement and testing, and principles of animal and human learning.

19.302 Psychology II (3 q.h.)

Principles of sensory processing, perception, motivation and emotion, and social influences on behavior. *Prereq.* 19.301 or equiv.

19.303 Psychology III (3 q.h.)

Personality theory and measurement, behavior disorders, mental health, and psychotherapy. *Prereq.* 19.302 or equiv.

19.307 Psychology (Intensive) (9 q.h.)

An introductory survey of the historical backgrounds of psychology, psychological measurement and testing, and principles of animal and human learning; principles of sensory processing, perception, motivation and emotion, and social influences on behavior; personality theory and measurement, behavior disorders, mental health, and psychotherapy. *(Not open to students who have taken 19.301, 19.302, 19.303.)*

19.308 Fundamentals of Psychology I (4 q.h.)

Basic concepts from most areas of psychological investigation; the experimental orientation to the study of behavior, including child development, individual differences, learning, and social psychology. (Recommended for psychology majors.) *(Not open to students who have credit for 19.301, 19.302, 19.303.)*

19.309 Fundamentals of Psychology II (4 q.h.)

The sensory basis of behavior, cognition, perception, motivation, emotions, normal and abnormal personality. (Recommended for psychology majors.) *(Not open to students who have credit for 19.301, 19.302, 19.303.)* *Prereq.* 19.308 or equiv.

21.301 Sociology I (3 q.h.)

Basic concepts and theories relating to the study of man as a participant in group life, with emphasis on social structure, culture, socialization, and the family. Course materials require competency in reading and writing skills.

21.302 Sociology II (3 q.h.)

A continuation of Sociology I, with major emphasis on primary groups, associations, social stratification, collective behavior, and population. Term papers or essays may be required. *Prereq.* 21.301 or equiv.

21.303 Sociology III (3 q.h.)

A continuation of Sociology II, focusing on the major institutional areas, with particular attention to problems of social, political, urban, and industrial change. *Prereq.* 21.302 or equiv.

21.304 Sociology (Intensive) (9 q.h.)

Basic concepts and theories relating to the study of man as a participant in group life, with emphasis on social structure, culture, socialization, and the family; primary groups, associations, social stratification, collective behavior, and population; the major institutional areas, with particular attention to problems of social, political, urban, and industrial change. Term papers or essays may be required. *(Not open to students who have credit for 21.301, 21.302, 21.303.)*

21.401 Principles of Sociology I (4 q.h.)

An intensive introduction to basic concepts and theories relating to the study of humans as participants in group life. Emphasis is placed on socialization, culture, social structure, primary groups, family, social stratification, and population. *(Not open to students who have credit for 21.302 or 21.303.)*

21.402 Principles of Sociology II (4 q.h.)

A continuation of Principles of Sociology I, with emphasis on a critical analysis of American society, with particular attention to problems of social, political, urban, and industrial change. *Prereq.* 21.401 or equiv. *(Not open to students who have credit for 21.302 or 21.303.)*

23.301 History of Civilization I (3 q.h.)

The beginnings of Western Civilization, with emphasis on the political, economic, and social history of ancient and medieval times to 1300.

23.302 History of Civilization II (3 q.h.)

Early Modern Europe from 1300 to 1789, with an examination of the two major intellectual movements, the Renaissance and the Enlightenment, and their impact on the rise of national states, capitalism, and Protestantism.

23.303 History of Civilization III (3 q.h.)

Modern Europe from 1789 to the present, emphasizing the rise of ideology in a technological age.

27.341 Drawing I (3 q.h.)

Practice in the techniques and development of drawing in pencil and pen and ink, with concentration on basic drawing problems.

27.342 Drawing II (3 q.h.)

Practice in the techniques of wash drawing, scratch board drawing, and mixed medias. *Prereq.* 27.341 or *equiv.*

27.343 Drawing III (3 q.h.)

Study of human anatomy and the practice of figure drawing and composition. *Prereq.* 27.342 or *equiv.*

30.301 English for International Students I (noncredit)

An introduction to the grammar and rhetoric of English as a second language. Practice in listening, speaking, and writing, with selected readings and exercises for vocabulary and pronunciation.

30.302 English for International Students II (noncredit)

An intermediate course in English as a second language. Practice in preparing written and oral reports, including business and social letters. *Prereq.* 30.301 or *equiv.*

30.303 English for International Students III (noncredit)

An advanced course in English as a second language. Practice in special forms of writing to broaden diction, syntax, and organizational techniques. *Prereq.* 30.302 or *equiv.*

30.304 Elements of Writing (formerly 30.600) (3 q.h.)

An intensive review of grammatical forms and structural patterns of current English. Practice in writing sentences, paragraphs, and short papers.

30.305 English I (3 cl., 3 q.h.)

A detailed examination of the modes of rhetoric, especially exposition and argument. Practice in writing short papers based upon readings of expository prose.

Note: Each student enrolled in English I (30.305) will take a Placement Examination during class. Some students may be requested to register for Elements of Writing (30.304), a 3 q.h. course designed to upgrade the student's background.

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30.306 English II (3 cl., 3 q.h.)

A detailed examination of the modes of rhetoric, especially description and narration. Practice in writing short papers and a fully documented library paper based upon readings of fiction. *Prereq.* 30.305.

30.307 English III (3 cl., 3 q.h.)

The development of techniques for understanding imaginative literature. Practice in writing short papers and a fully documented library paper based on readings of poetry and drama. *Prereq.* 30.306.

30.113 Freshman Writing (4 cl., 4 q.h.) (Day Curriculum)

Important principles of logic and rhetoric applied to exposition and argumentation writing; review of sentence structure, punctuation, and paragraphing; extensive reading and analysis of the essay form; theme assignments.

30.114 Introduction to Literature (4 cl., 4 q.h.) (Day Curriculum)

An introduction to literary forms: poetry, prose, fiction, and drama; intensive reading in various forms and discussion of different approaches to literature. *Prereq.* 30.113.

30.115 Great Themes in Literature (4 cl., 4 q.h.) (Day Curriculum)

Content determined by instructor, who chooses a theme and a number of books from different periods to illustrate it. Examples: The Hero in literature, Visions of Utopia, Science Fiction, etc. *Prereq.* 30.114.

30.410 Technical Writing I (3 q.h.)

Introduces the history and principles of technical writing. Improves basic technical writing skills by providing practice in basic descriptive writing, writing definitions, and preparing outlines and abstracts. Provides practice in improving research skills with a guided library research project in the field of technical writing. Considerable writing practice is provided.

30.411 Technical Writing II (3 q.h.)

Provides exposure to and practice in various types of technical writing, including descriptions of objects, mechanisms, and process. Develops a student's capability in preparing various types of reports, including progress reports, recommendations, and oral reports. Introduces the preparation of proposals and use of graphic aids in supporting the writing process. Considerable writing practice is provided. *Prereq.* 30.410.

30.412 Technical Writing (Intensive) (6 q.h.)

Equivalent to 30.410 and 30.411.

30.415 Proposal Writing (3 q.h.)

Provides a background in the preparation of proposals, including ability to analyze a request for proposal (or bid set). Introduces the various types of proposals generated by industry and provides an opportunity to prepare a proposal in a simulated situation, through role playing and participation in a proposal preparation team. Considerable analysis and writing practice is provided. *Prereq.* 30.411 or permission of instructor.

30.420 Electronic Technical Manual Writing I (3 q.h.)

Introduces individuals who are competent in appropriate technical fields to the theory and practice of documenting the installation, operation, theory, and maintenance of electronic instruments and systems for industrial, aerospace, military, and medical applications. *Prereq.* 30.411 or permission of instructor.

30.421 Electronic Technical Manual Writing II (3 q.h.)

A continuation of 30.420, with special attention to developing the skills appropriate to writing each of the sections normally comprising an electronic instrument operating manual. Includes problems in organizing a typical manual, presentation of technical theory, maintenance procedures, test and adjustment procedures for updating manuals as well as cataloging replaceable parts. *Prereq.* 30.420.

30.425 Computer Software Technical Writing I (3 q.h.)

A two-quarter course designed to introduce the tasks and problems unique to software technical writing. Major topics include: review of fundamental software concepts; role and importance of software documentation; component parts of software technical manuals and their purposes; tutorial and reference functions of manuals; research tools for manual writing; and the writing process itself. *Prereq.* 30.410 and 49.311 or permission of instructor.

30.426 Computer Software Technical Writing II (3 q.h.)

A continuation of 30.425. *Prereq.* 30.425.

BUSINESS MANAGEMENT

Students wishing to elect other business courses should refer to the University College Catalog and petition for approval by the Academic Standing Committee of Lincoln College.

39.115 Principles and Problems of Economics (4 cl., 4 q.h.) (Day Curriculum)

An introduction to the conceptual aspects of economics; the flow of national income; economic growth and fluctuation; the role of money and banking; monetary and fiscal policies. Emphasis on developing conceptual tools for use in the analysis of economic problems facing modern society.

39.301 Economic Principles and Problems I (3 q.h.)

Development of macroeconomic analysis; review of national income concepts; national income determination, fluctuation, and growth; role of the banking system and the Federal Reserve System; government expenditures and taxation; international trade; balance of international payments.

39.302 Economic Principles and Problems II (3 q.h.)

The role of a market pricing system, supply and demand, in determining the allocation of resources to competing uses and why this system may not function adequately in certain areas. Application of economic principles to private and public problems in such areas as pollution, poverty, and racial discrimination. *Prereq.* 39.301 or equiv.

39.303 Economic Principles and Problems III (3 q.h.)

Applications of economic principles to selected problem areas; poverty, competition, labor, agriculture, urban. *Prereq.* 39.302 or equiv.

39.311 Statistics I (3 q.h.)

Introduction to the collection and organization of data; concentration on the nature, computation, and uses of measures of central tendency and variability. *Prereq.* 39.303 or equiv.

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39.312 Statistics II (3 q.h.)

Introduction to statistical inference, parameters of samples, tests of significance, "t" distribution, and chi square. *Prereq. 39.311 or equiv.*

39.313 Statistics III (3 q.h.)

Introduction to the analysis of variance, trend fitting, linear regression, seasonal adjustment, and index numbers. *Prereq. 39.312 or equiv.*

39.314 Statistics (Intensive) (9 q.h.)

Introduction to the collection and organization of data; concentration on the nature, computation, and uses of measures of central tendency and variability; introduction to statistical inference, parameters of samples, tests of significance, "t" distribution and chi square; introduction to the analysis of variance, trend fitting, linear regression, seasonal adjustment and index number. *(Not open to students who have credit for 39.311, 39.312, 39.313.) Prereq. 39.303 or equiv.*

41.301 Accounting Principles I (3 q.h.)

The basic concepts and methodology of accounting for service and merchandising businesses, and accounting for business assets. *(Offered every quarter on all campuses.)*

41.302 Accounting Principles II (3 q.h.)

Emphasizes financial reporting, income measurement, valuation and appraising the financial results of business operations. Replaces 41.501, 41.502, 41.503. *Prereq. 41.301.*

41.304 Accounting Principles (Intensive) (6 q.h.)

Same as Accounting Principles I and II. Replaces 41.541.

45.301 Management and Organization I (3 q.h.)

To introduce the new business person to the setting and general structure of American business, which includes objectives and practices as they affect the American standard of living; the characteristics of private enterprise, and the nature and challenge of capitalism and other forms of economic enterprise. The student is introduced to the forms of business, both large and small; to the structures of organization; the functions of management as they tend to influence the various forms of business. Offers the opportunity for understanding what a career on the management level of organizations involves; what problems must be faced; and what decisions must be reached.

45.302 Management and Organization II (3 q.h.)

To introduce the business person to methodologies in planning, organizing, directing, and controlling the functions of production, marketing, sales, and pricing as they relate to the American free enterprise system as contrasted to other systems of international business. Examination of modern, effective, and proven tools and techniques for coping with the myriad interrelationships and intricacies of systems management. Develops a more comprehensive understanding of the total structure of business and other enterprises. *Prereq. 45.301.*

45.303 Principles and Practices of Management (3 q.h.)

Takes the student from definitions and fundamentals of business to basic concepts relating to the functions of management and to the analytical techniques which are necessary to successful decision making. Emphasizes that management is a continuous process of action by involving the student in "how to" design an organization, understand and deal with people, evaluate the political, social, and economic environment, effectively plan, direct, and control the organization. Short cases and professional articles, included in the text, provide provocation material for discussion and reinforcement of management concepts. *Prereq.* 45.301.

48.301 Elements of Transportation (3 q.h.)

An introduction to regulatory, economic, and management aspects of transportation from the viewpoint of shippers, government, and carrier management. Topics include: cost, rates, operations, entry, mergers, and intercity passenger carriage. A course of general interest to students of business, law, or government.

48.302 Physical Distribution Management (3 q.h.)

An introduction to the physical distribution management concept. Topics include: inventory control, warehousing, cost control, and locational strategy. Course uses text and case materials developed from industry situations.

48.303 Organization and Control of Physical Distribution Management (3 q.h.)

Establishment of the firm's physical distribution organization. Interrelationships with other company functions. Examination of advanced physical distribution problems.

48.304 Management of Warehouse Operations (3 q.h.)

A practical course in the management of warehouses. Topics include: site selection, construction, finance, operations, measurement of performance, and warehouse technology.

48.305 Traffic Management I—Rates and Tariffs (3 q.h.)

A practical course in the interpretation and use of tariffs. Topics include: classifications, rate scales, tariff rules, rate-making procedures, and ICC law and practice.

48.306 Traffic Management II—Selected Topics (3 q.h.)

Further study of traffic management, covering such topics as routing, claims, insurance, consolidation, and packaging. *Prereq.* 48.305.

48.307 Contemporary Issues in Transportation and Distribution (3 q.h.)

Focuses attention on a limited number of topics which are of particular interest during the current academic year.

48.308 Transportation Regulation and Promotion I (3 q.h.)

Study of the history and content of the Interstate Commerce Act.

48.309 Transportation Regulation and Promotion II (3 q.h.)

Study of administrative law and procedures, the code of ethics, and general rules of practice. Analysis of cases pertinent to the Commerce Clause. Preparation for the ICC Practitioners Exam. *Prereq.* 48.308.

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48.310 Surface Transportation I—Railroad Management (3 q.h.)

A management-oriented course that considers the current and future status of the railroads. Topics include: investment and finance, mergers, marketing, labor relations, diversification, and public policy.

48.311 Surface Transportation II—Motor Carrier Management (3 q.h.)

A management-oriented course that examines the regulated motor-carrier industry. Topics include: equipment selection, finance, mergers, marketing, labor relations, routes, operations and control, and public policy.

48.312 Surface Transportation III—Marine Transportation (3 q.h.)

A management-oriented course that examines the U.S. Merchant Marine. Topics include: international trade patterns, government promotion and regulation, technological innovations, port facilities, and labor relations.

48.313 Surface Transportation IV—Private Trucking (3 q.h.)

Beginning a private trucking operation. Topics include: legal guidelines, purchase vs. lease, operations, and performance measurement.

48.314 Air Transportation (3 q.h.)

Economics and regulation of Civil Aeronautics Board certified air carriage. Topics include: entry, operations, pricing, mergers, cost analysis, and financing.

48.315 Urban Transportation (3 q.h.)

The scope and status of transportation in our metropolitan area. Examination of the planning and financing of urban transportation systems. The role of local, state, and Federal government units. The problems of transit management.

48.316 Carrier Management (3 q.h.)

The transportation system from the carrier viewpoint; managerial response to a heavily regulated and rapidly expanding environment; focus on carrier decision making, including routes, scheduling, financing, and pricing of services.

SUPPLEMENTAL COURSES

93.305 Survival Training (2 cl., 2 q.h.)

Training in and demonstration of modern techniques of human survival; methods in the wilderness environment.

93.306 Flight Safety Seminar (2 cl., 2 q.h.)

The case-study method will be used to increase the pilot's awareness of some of the most important factors affecting aviation safety. Official aircraft accident reports released by the National Transportation Board of significant aviation accidents will be used at the beginning of each case study. Elements to be included: aircraft reliability, air traffic control system, weather, regulations, and pilot skills.

93.401 Technical Communications (4 cl., 4 q.h.) (Aeronautical Program)

Thought organization and effective sentences; written reports and instruction manuals; specifications and proposals; graphic aids and reproduction processes. *Prereq.* 30.602.

93.402 Technical Communications I (2 cl., 2 q.h.)

Thought organization and effective sentences; written reports and instruction manuals.
Prereq. 30.602.

93.403 Technical Communications II (2 cl., 2 q.h.)

Specifications and proposals; graphic aids and reproduction processes. *Prereq.* 93.402.

93.404 Technical Communications (3 q.h.)

Thought organization and effective sentences; written reports and instruction manuals; specifications and proposals; graphic aids, and reproduction processes. *Prereq.* 30.306, or 30.304 and 30.305.

93.502 Technical Mathematics (4 cl., 4 q.h.)

Fundamental algebraic operations; complex numbers; radicals and exponentials; logarithms; linear and quadratic equations; trigonometric functions of angles; identities; triangles and complex numbers in trigonometric form. Coverage adapted to the requirements of the program.

93.504 Electrical Circuits and Electronics I (4 cl., 4 q.h.)

Basic definitions; current, voltage, resistance, capacitance, inductance, power and energy sources; circuits, circuit laws and theorems. Diodes, bipolar and field-effect devices, biasing techniques. Introduction to a basic amplifier.

93.506 Electrical Instruments and Measurements (4 cl., 4 q.h.)

Combination of lectures, demonstrations, and experiments conducted in the laboratory. Introduction to the basic electronic instruments and electrical measurements. Demonstrations and experiments, based on and in parallel with the material presented in the lectures.

93.508 Electrical Circuits and Circuits Laboratory II (4 cl., 4 q.h.)

AC theory; impedance; introduction to frequency domain; spectrum and filters; Bode plots. *Prereq.* 93.502, 93.504, 93.506.

93.510 Electronics and Electronics Laboratory II (4 cl., 4 q.h.)

Small signal semiconductor device models and amplifier circuits. Cascading of stages. *Prereq.* 93.502, 93.504, 93.506.

Note: Laboratory work is based on the material covered in the lectures. Included are demonstrations by the instructor, as well as experiments performed by the student to reinforce the material presented in respective lectures. The laboratory work will follow the lecture on the same night.

93.512 Cable Communications and Cable Laboratory I (4 cl., 4 q.h.)

Lectures, demonstrations, and experiments to introduce the student to the principles of cable communication system: introduction to modulated signal-transmission systems, transmission line characteristics, cascaded amplifiers and repeaters. *Prereq.* 93.502, 93.504, 93.506.

93.514 Electronics II and Electronics Laboratory III (4 cl., 4 q.h.)

Introduction to digital electronics and logic circuits; fundamentals of Boolean algebra; gates, flip-flops, registers and counters, logic families. *Prereq.* 93.508, 93.510, 93.512.

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93.516 Cable Communications II and Cable Laboratory II (4 cl., 4 q.h.)

Video and cable-system performance tests, and tests and measurements; modulation-demodulation tests; transmission line and repeater-amplifier tests, and distortion measurements; FCC proof of compliance/performance measurements. *Prereq.* 93.508, 93.510, 93.512.

93.518 Special Topics and Special Topics Laboratory (4 cl., 4 q.h.)

Satellite receiving and the head-end systems; cable-system design; and other related topics. *Prereq.* 93.508, 93.510, 93.512.

93.550 Concepts of Modern Technology I (3 q.h.)

A survey of the applications of physical science to mechanical devices. An introduction to the laws of thermodynamics. The influence of material properties on design and manufacturing techniques. *Prereq.* 10.382 or *equiv.*

93.551 Concepts of Modern Technology II (3 q.h.)

A survey of the applications of physical science to electrical and electronic devices. An introduction to electronic circuit design. A comparison of various devices used for amplification and control. A study of the development of the electronic digital computer and the components involved in the manufacture of computers. *Prereq.* 93.550.

93.552 Measurement and Analysis (3 q.h.)

A survey of instruments and techniques used to assure performance of electrical and mechanical components. An introduction to trouble-shooting and automated testing. A study of destructive and nondestructive tests and their relationship to each other. *Prereq.* 93.550 and 93.551.

93.553 Modern Electronics (3 q.h.)

A survey of components available to the designer of electronic devices, including linear integrated circuits and digital building blocks. Topics discussed will include: operational amplifier characteristics; truth tables and the synthesis of digital logic; logic families and specifications; counters, registers and decoding; digital instruments, digital to analog conversion. *Prereq.* 93.551.

93.554 Theory and Operation of Computers (3 q.h.)

An introduction to digital computer design and operation. Design topics include Boolean algebra, synthesis of switching networks, and an introduction to general computer architecture and organization. Operational topics include input and output devices, systems development, programming tools, data communication, time sharing, data-base principle. *Prereq.* 10.382 or *equiv.*

93.610 Solar Water Heating (2 cl., 2 q.h.)

General types of solar water heaters; basic science and historical development of solar water-heating systems; design and installation of a typical system; cost benefits and savings; maintenance and payback.

93.611 Solar-Heating Design (2 cl., 2 q.h.)

Fundamentals of heat, heat transfer, insulation; sun angles, intensity and siting problems; system layouts; heat storage and heat exchangers; controls and sensing devices; design calculations and design practice. *Prereq.* 93.610.

93.650 The Technical Presentation (3 q.h.)

The application of technical communication to audiovisual presentations. Includes audience analysis, techniques of organization, script preparation, media selection, the design and production of visuals, the influence of physical factors on communication, and the elements of effective delivery. Participants will prepare and deliver technical presentations with video playback and peer critiques.

AERONAUTICAL TECHNOLOGY

Descriptions of flight training courses are included solely to provide guidelines for students in the flight portion of the Aeronautical Technology program.

96.308 Aircraft Power and Systems (4 cl., 4 q.h.)

Engine types, nomenclature, and engine development; engine cycles and principles, performance, power and its measurement, ratings; engine parts and their functions; valve mechanisms and timing; cooling system, carburation, fuel system, ignition system, lubrication, and oil system; batteries, propeller and engine breathing system.

96.324 Introductory Avionics (4 cl., 4 q.h.)

Basic coverage of electronics, including: vacuum tube principles, semiconductor physics principles, power supplies, amplifiers, oscillators, and pulse circuits; generator and motor principles and applications; basic concepts of avionics, electrical hazards, aircraft electrical systems, electrical instruments, strobe lights, FCC regulations, radio communications, and antennas. *Prereq. 11.619, 10.608.*

96.325 Avionics (4 cl., 4 q.h.)

Reliability and maintainability of avionics, automatic direction finders, marker beacons, omnirange and localizers, audio switching systems. ATC transponders, glide slope systems, distance measuring equipment, autopilots, missile guidance, and new state-of-the-art avionics. *Prereq. 96.324.*

96.334 Private Flight Laboratory (8 lab., 4 q.h.)

Consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the private pilot certificate, airplane rating, single engine. *Prereq. Class I or II medical certificate.*

96.335 Instructional Flight Laboratory (6 lab., 3 q.h.)

Consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the instructor certificate, airplane rating, single engine. *Prereq. 96.339.*

96.336 Instrument Instructor Laboratory (4 lab., 2 q.h.)

Consists of necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the instrument flight instructor rating, airplane, single engine. *Prereq. 96.335.*

96.338 Commercial Flight Laboratory (16 lab., 8 q.h.)

Consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the commercial pilot certificate, airplane rating, single engine. *Prereq. 96.334.*

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96.339 Instrument Flight Laboratory (8 lab., 4 q.h.)

Consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the instrument rating, airplane. *Prereq.* 96.334 or 96.439.

96.340 Multi-Engine Flight Laboratory (2 lab., 1 q.h.)

Consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the multi-engine rating, airplane. *Prereq.* 96.334.

96.358 Helicopter A (2 lab., 2 q.h.)

This course, in conjunction with part B, consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the helicopter rating. *Prereq.* *Commercial Fixed Wing License; Class I or II medical certificate.*

96.359 Helicopter B (2 lab., 2 q.h.)

This course, in conjunction with part A, consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the helicopter rating. *Prereq.* 96.358.

96.404 Fundamentals of Aeronautics (4 cl., 4 q.h.)

Aircraft structures and components; aerodynamic forces; airfoil terminology—lift and drag coefficient; boundary layer problems and control; earth in space latitude; longitude; properties and components of the atmosphere; map projections, dead reckoning; reciprocating engine theory; planform effects; aircraft weight and balance. Radio navigation; VOR, ADF, DME, and TACAN; airplane performance (climb, range, altitude, takeoff, and landing); aircraft propeller theory and operation; specific aircraft substructures (landing gear, etc.) advanced DR navigation problems (radius of action, unknown wind); physiology factors of flight; general review. Federal Aviation Regulations for Private Pilot.

96.405 Weather Station Operation and Observations I (4 cl., 4 q.h.)

Design, care, and operation of meteorological instruments, observing, coding and recording data for aviation and synoptic reports. Map plotting, analysis, and use. Pseudoadiabatic diagram plotting and use. Routine duties of weather observer. Elementary forecasting theory. Trips to local weather stations, flight service stations, and weather radar installations. *Prereq.* 96.396.

96.406 Weather Station Operation and Observations II (4 cl., 4 q.h.)

A continuation of Weather Station Operation and Observations I. *Prereq.* 96.405.

96.407 Flight Engineering I (4 cl., 4 q.h.)

This is a preliminary course giving the student the basic knowledge and exposure of the operating systems of large transport type aircraft. They will receive the basic systems knowledge of the Boeing 727. The major area of concentration will be aircraft general, pneumatic systems, hydraulic systems, fuel systems, electrical systems, pressurization systems, and engine operations. Upon successful completion of this course and recommendation from the instructor, the student will be permitted to proceed with Flight Engineering II. *Prereq.* *Commercial License, Instrument Rating.*

96.408 Advanced Flight Mechanics (4 cl., 4 q.h.)

Aerodynamics, performance, stability and control, flight efficiency. *Prereq.* 96.437.

96.409 Practice of Flight Instruction (4 cl., 4 q.h.)

Fundamentals and principles of instructing; learning concepts of teacher procedures. Preparation for Federal Aviation Administration fundamentals of instruction written exam. Practice for basic, advanced, and instrument Federal Aviation Administration ground instructor exam. *Prereq.* *Permission of staff.*

96.410 Aviation History I (4 cl., 4 q.h.)

Detailed historical analysis from the dawn of aviation to World War II of efforts in manned flight, aircraft development, pioneers in flight, general aviation, military and commercial aspects of flight, and effects on modern civilization.

96.411 Aviation History II (4 cl., 4 q.h.)

A continuation of detailed historical analysis from the beginning of World War II through the space age. *Prereq.* 96.410.

96.412 Aviation Safety I (4 cl., 4 q.h.)

Commuter and multi-engine aircraft accidents. The course is divided into two sections. The first section deals with commuter airlines safety problems. A general view of commuter airline problems will be given. This will be followed by two case studies. The second section deals with the differences in two-engine operating requirements, according to the section of the Federal Aviation Regulations under which the aircraft is certified. Differences in safe operating procedures will be examined in detail. Commonly misunderstood terms of vital importance to safe multi-engine aircraft operation will be explained and illustrated.

96.413 Aviation Safety II (4 cl., 4 q.h.)

San Diego: A case study. A thorough examination of the various factors involved in the worst mid-air collision in American civil aviation history and its aftermath. Elements analyzed in detail include: FAA regulations and policies; air traffic control procedures; the actual tapes between air traffic controllers and pilots; pilot's cockpit conversations; eye-witness reports; National Transportation Safety Board's public hearing and subsequent report; Congressional hearings; news media coverage and resulting legal ramifications. An extensive multi-image slide presentation is used to aid the student's comprehension of time, critical events, and ultimate consequences. *Prereq.* 96.412.

96.414 Aviation Safety III (4 cl., 4 q.h.)

Significant aviation accidents/incidents: Case studies of aircraft accidents/incidents selected because of the vital issues of aviation safety involved. Drawing upon the student's knowledge acquired from the San Diego case study, the vital issues of a number of important aviation accidents will be studied. Each case study will focus only upon the most important elements, so that the study may gather a broad perspective of the safety issues involved. Case studies to be presented, among many, include the worst crash in American civil aviation and the collision at Tenerife—the worst disaster in aviation history. *Prereq.* 96.413.

96.415 Advanced Meteorology and Climatology (4 cl., 4 q.h.)

Physical approach to pressure, temperature, basic thermodynamics, stability, and cloud formations; elementary polar front theory; the general circulation of the atmosphere; climate causes and effects; climatology of several regions of the world; application of climatology to problems of airport location and construction, airline operation, and general aviation. *Prereq.* 96.444.

94.416 Flight Operations and Traffic System Seminars (4 cl., 4 q.h.)

Discusses complex topics pertaining to such areas as the air traffic system, aircraft operation, and weather. Content will generally be flexible to satisfy the participant's demand for solutions to problem areas. Experts in various fields will generally be employed as guest lecturers to enhance the course. *Prereq. Permission of staff.*

96.417 General Aviation Operations (4 cl., 4 q.h.)

A presentation of the major functions and problems of current airport management; organization, zoning, adequacy, financing, revenues and expenses, evaluation, and safety; the airport and its socioeconomic effect on the community. Study and analysis of airport functions, such as fixed-base operators, pilot training schools; airtaxi operations in both charter and schedule activities, corporate aviation. Master planning of airports is introduced in a general manner. *Prereq. none.*

96.418 Intermodal Transportation (4 cl., 4 q.h.)

An overview of the major characteristics and current problems of each mode of transportation—air, rail, maritime, intercity, bus, motor carrier, and transit. Probes the inter-relationships among the major modes of transportation. *Prereq. none.*

96.419 Air Cargo (4 cl., 4 q.h.)

Study of commercial airline and air freight forward cargo practices, with emphasis on regulation, economics, marketing, handling, and organizational aspects.

96.420 Airline Traffic and Sales (4 cl., 4 q.h.)

Functions of the commercial airline traffic and sales department, relationship between the travel agencies and the airlines, relationships with other carriers, reservations and the procedures involved in the interline of the passenger to another carrier; airlines promotion. Tariffs and schedules, with an explanation of how flight times are established; flight summary frequencies; new routes; establishment of ticket fares, aspects of cargo and charters. *Prereq. none.*

96.421 Air Traffic Control System (4 cl., 4 q.h.)

Survey of the total aerospace system and management; air traffic administrative coordination; regional responsibilities; NAFEC organization of center, tower, and station. *Prereq. 96.437 or 96.438.*

96.422 Flight Physiology and Survival Techniques (4 cl., 4 q.h.)

The study of the physical and chemical processes of the body; functions of the living body and its environment; adaptive changes of function of the body resulting from a change in environment, with emphasis on flight; the effects of medication on the function and reactions of the body, with emphasis on flight; the effects of the state of the mind on the function and reactions of the body, with emphasis on flight. Training in and demonstration of modern techniques of human survival methods in the wilderness environment. *Prereq. none.*

96.423 Turbine Engines (4 cl., 4 q.h.)

A presentation of turbine engine types and their development; centrifugal flow and axial flow types, turbo-prop, turbo-shaft, turbo-jet, turbo-fan, ram jets, pulse jets and rockets; principles of combustion and propulsion, performance, power, thrust, and their measurement; fuel, lubrication, and ignition systems. *Prereq. 96.308.*

96.430 Aviation Preventive Maintenance (2 cl., 2 q.h.)

For pilots and aircraft owners. Airframe and powerplant nomenclature, structures, and systems; maintenance that a pilot can and is allowed to do to the airframe and engine of his aircraft; proper techniques.

96.434 Aircraft Accident Investigation and the Aviation Professional—A
(4 cl., 4 q.h.)

Purpose and legal source of aircraft accident investigation; the rights, obligations, and limitations of the National Transportation Safety Board (NTSB); Federal Aviation Administration (FAA), parties-to-the-investigation. *Prereq.* *Permission of staff.*

96.435 Aircraft Accident Investigation and the Aviation Professional—B
(2 cl., 2 q.h.)

A condensed version of 96.434. *Prereq.* *Permission of staff.*

96.437 Advanced Aeronautics (4 cl., 4 q.h.)

Aircraft structural limitations, aerodynamics and forces, aircraft weight and balance, advanced airplane performance, stability and control, spins and commercial flight maneuvers, high performance aircraft, commercial pilot Federal Air Regulations, introduction to part 135 FAR's and introduction to flight engineering; preparation for airplane commercial written test. *Prereq.* 96.404.

96.438 Instrument Procedures (4 cl., 4 q.h.)

Aerodynamics, instrument flight charts; IFR planning; aviation weather; instrument flight rules; static and dynamic stability of aircraft; control movements and forces. Spins and spin recoveries; clearance notation; aircraft performance; instruments and scanning procedures; structural strength limitations; precision approach radar and airport surveillance radar; pressure pattern flight. Preparation for Federal Aviation Administration instrument written exam. *Prereq.* 96.404.

96.439 Advanced Flight Laboratory (4 q.h.)

Consists of the necessary flight training and instruction to satisfy the minimum Federal Aviation Administration requirements to apply for the flight test for the commercial pilot certificate, airplane rating, single engine. *Prereq.* 96.334.

96.440 Introduction to Aircraft Design (4 cl., 4 q.h.)

Basic orthographic principles and interpretations of aircraft design; a presentation of basic aerodynamics, structural characteristics of aircraft, materials, and manufacturing processes. *Prereq.* 10.307.

96.441 Introduction to Aerodynamics (4 cl., 4 q.h.)

A noncalculus presentation of basic fluid dynamics and principles of fluid flow includes continuity, Bernoulli, and momentum equations; streamlines, stream tubes, drag, theory of lift, wing theory, vortex flow, ground effect, stalls, boundary layer, flow separation, control surfaces, stability, and balance. *Prereq.* 10.608 and 11.618 or 10.408 and 11.418.

96.442 Basic Helicopter Aerodynamics (4 cl., 4 q.h.)

General aerodynamics; helicopter components and their functions; loads and load factors; gyroscope precession principle; performance; introduction to flight manual, helicopter operations in confined areas, precautionary measures and critical conditions. *Prereq.* 96.404.

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96.443 Aircraft Systems (4 cl., 4 q.h.)

Hydraulic, pneumatic, electrical, and mechanical systems; landing gear types, design loads and limitations; landing gear retraction systems; general flight control systems, including rudder, elevator, aileron, and flaps, loads and limitations, deicer systems for flight surfaces, cabin pressurization and oxygen systems; electrical and air-driven instrument systems. Analysis of high performance business aircraft systems. *Prereq.* 96.437.

96.444 Meteorology and Climatology (4 cl., 4 q.h.)

A survey of the principles and structure of the atmosphere; pressure systems and fronts; tropical meteorology; meteorological instruments and observations; weather map interpretation and common aviation weather teletype codes. *Prereq.* 11.418.

96.445 Advanced Flight Mechanics (4 cl., 4 q.h.)

Aerodynamics, performance, stability and control, flight efficiency. *Prereq.* 96.437.

96.500 Tactical Air Field Refueling System (cl. special, 4 q.h.)

Classroom and practical training will be utilized to assure student capability to both operate and maintain the tactical air field refueling system. Practical applications to make the student aware of 1) set up; 2) terrain features; 3) operation of pumps and bladders for possible problems and actions to be taken; 4) fuel testing for contamination. Will be conducted utilizing the actual physical equipment.

the lincoln college faculty

The strength of an educational institution lies in the quality of its faculty. This is especially true in a college devoted to the training of mature men and women, many of whom are already employed in their chosen professions.

The instructional staff of Lincoln College is composed of professional academicians from Northeastern University and neighboring educational institutions, and practicing professionals from the scientific and industrial community of Greater Boston. The theoretical training and practical experience represented by this combination of specialists is ideally suited to the technology programs they teach and the adult students they serve.

The faculty are selected for their ability and active interest in the welfare of ambitious part-time students. They are men and women of culture and high ideals, and are qualified by educational training and professional experience to teach effectively in their respective fields.

A staff of experienced professional educators who serve as program and course consultants constitutes the Academic Advisory Council and Curriculum Advisory Committee of the College. They guide, supervise, and assist with the administration of courses and programs.

THE FACULTY

The following is an alphabetical list of the faculty of Lincoln College; degrees earned; professional affiliation; and Lincoln College department (year of appointment).

Arnold M. Aaron, B.S., M.S., Ph.D.
Engineer, Naval Underwater Systems Center
Electrical Engineering Technology (1974)

Velda Adams, M.S.
Member, Technical Staff, GTE Labs.
Computer Technology (1980)

*Arnold W. Almquist, Jr., B.S., M.Ed.
Instructor, Math. Dept., Needham High School.
Mathematics (1967)

Peter Anderson, B.S., M.S.,
Electrical Engineer, Stein Associates, Inc.
Electrical Engineering (1976)

Will C. Anderson, B.S., M.S.
Supervisor, Software Engineering, Digital Equipment Corp.
Computer Technology (1968)

*Appointed to the rank of Senior Lecturer

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- *Robert B. Angus, Jr., B.S., M.S., P.E. (Mass.)
Principal and Consultant, Angus Associates
Electrical Engineering Technology (1947)
- Russell S. Arena, A.S., B.S.
ASSWT-Chief Pilot, E.W. Wiggins Airways, Digital Equipment Corp.
Aeronautical Technology (1980)
- *Robert J. Averill, B.S., M.S.
Executive Vice President, Sala Magnetics, Inc.
Course Consultant, Electrical Engineering Technology (1957)
- *Russell H. Babcock, S.B., S.M., P.E. (Mass., Maine, N.H., R.I., Vt., Conn., N.Y., Fla.)
Diplomate, American Academy of Environmental Engineers;
Consulting Engineer, Private Practice
Civil Engineering Technology (1954)
- John C. Balsavich
Laboratory Supervisor, Electrical Engineering, Northeastern University
Electrical Engineering Technology (1957)
- Henry G. Barry, M.Ed.
Newton School System
Mathematics (1979)
- Adolph Baumann, B.S., P.E. (Mass.)
Telecommunications Eng., GTE Sylvania
Electrical Engineering Technology (1955)
- *Matteo P. Berardi, B.S., M.S.E.I.T. (Mass.)
Supervisor, Stone & Webster Eng. Corp.
Mechanical Engineering Technology (1960)
- Maureen P. Berggren, B.S.
Mathematics (1965)
- Ralph S. Blanchard, B.S.M.E., M.S.M.E., P.E. (Mass.)
Assistant Dean, College of Engineering, Northeastern University
Assoc. Program Consultant, Mechanical Engineering Technology (1950)
- Robert E. Bobeck
Professor, Bristol Community College
Engineering Graphics (1976)
- *Edward Bobroff, B.M.E.
Engineering Consultant, Medical Area Total Energy Plant
Program Consultant, Mathematics (1946)
- Alan Bradshaw, B.S., M.S., C.A.G.S. (Mass.)
Principal, Chelmsford School System
Mathematics (1966)
- *Eugene G. Branca, S.B., S.M.
Assistant Headmaster (Retired), Hyde Park High School
Course Consultant, Mathematics (1946)
- *Donald H. Breslow, S.B., M.S.,
Director of Engineering, Measurement Systems Division, Itel Corp.
Electrical Engineering Technology (1959)
- *Donald C. Brock, B.S., M.S.
Mathematics Instructor, Needham High School
Mathematics (1965)
- *Franklyn K. Brown, B.S.Ed., M.Ed.
Associate Professor, Design Graphics, Northeastern University
Course Consultant, Engineering Graphics and Computation (1955)
- Jeffrey L. Bruce, B.S., M.A.
Software Engineer, Raytheon Missiles Division
Mathematics (1969)

*Appointed to the rank of Senior Lecturer

- *Morris H. Burakoff, B.S., P.E. (Mass.)
Department Chief, Western Electric Company
Electrical Engineering Technology (1957)
- *Leroy M. Cahoon, B.S.C.E., M.S., P.E. (Mass., Connecticut)
Associate Professor of Civil Engineering, Northeastern University
Program Consultant, Civil Engineering Technology (1962)
- *Frank R. Cangiano, B.S., Ed.M.
Instructor in Science and Mathematics, Medford High School
Mathematics (1957)
- Barry S. Canner, A.S., C.E.T., A.T.P., C.F.I.A.I.
Assistant Chief Flight Instructor, Wiggins Airways
Aeronautical Technology (1970)
- Edgar T. Canty, B.S., M.S.
Director, Academic Computing Services, Babson College
Mathematics (1966)
- Joseph M. Cardito, B.S., M.S., Ph.D., P.E. (Mass.), C.H.P. (Amer. Brd. Health Physics)
Radiation Protection Analyst, Nuclear Fuels Engineer, Stone & Webster Eng. Corp.
Mechanical Engineering Technology (1978)
- William B. Carter, A.B., S.M.
Information System Specialist, Polaroid Corporation
Computer Technology (1974)
- Robert W. Case, Ph.D.
Coordinator for Day Program, Lincoln College
Mathematics (1976)
- *Walter J. Casey, A.B., M.Ed., M.A.T.
Dept. Chairman, Brighton High School
Mathematics (1955)
- Margret P. Casper, A.B., M.Ed.
King Philip Regional School District
Mathematics (1977)
- Joan M. Chrusciel, B.S., M.Ed., M.A.
Mathematics Teacher, Quincy High School
Mathematics (1980)
- Vincent L. Cocco, B.S.
Senior Engineer, Polaroid Corporation
Mechanical Engineering Technology (1978)
- Thomas C. Coleman, B.S.M.E., M.S.M.E., Ph.D., P.E. (Mass.)
Supervising Mech. Engineer, United Engineering and Construction
Course Consultant, Mechanical Engineering Technology (1960)
- Wendell R. Collymore
Drafting Supervisor, Polaroid Corporation
Engineering Graphics (1976)
- Leonard M. Conlin, A.B., Ed.M.
Mathematics Teacher, Framingham North High School, Boston College M.A.T. Program
Mathematics (1967)
- *Roger T. Connor, A.B., M.Ed.
Principal, Milton High School
Course Consultant, Calculus (1953)
- *Robert J. Connors, B.S.
Manager of Technology, Electronic Systems, Sylvania Electric Products, Inc.
Electrical Engineering Technology (1948)
- *Joseph Z. Cooper, B.S.E.E.
Principal Engineer, Raytheon Company
Computer Technology (1967)
- *Appointed to the rank of Senior Lecturer

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- *James B. Corscadden, B.S., M.Ed., A.M.T.
Assistant Headmaster, South Boston High School
Mathematics (1967)
- Robert J. Cox, B.S.
Project Manager, General Contracting
Civil Engineering Technology (1979)
- Laurence M. Coyle, B.S., M.S.
Senior Electrical Engineer, Smithsonian Astrophysical Observatory
Electrical Engineering Technology (1980)
- David C. Crockett, B.S., M.S.
Senior Engineer, Raytheon Company
Mechanical Engineering Technology (1969)
- Steven S. Cushman, B.S.
Software Consultant
Computer Technology (1977)
- Mukti Lal Das, B.S., M.S., Ph.D., P.E. (Mass.)
Manager of Engineering Program Applications, Charles T. Main, Inc.
Civil Engineering Technology (1972)
- *Herbert R. Davenport, B.S.E.E.
Standards Engineer, GenRad Inc.
Electrical Engineering Technology (1948)
- *Warren C. Dean, A.B., M.A.
Professor of Mathematics, Northeastern University
Mathematics (1941)
- Charles A. DeAngelis, B.S., M.S., P.E. (Mass., Ind.)
Senior Structural Engineer, Stone & Webster Eng. Corp.
Civil Engineering Technology (1976)
- *John L. Dearness, A.S.E.E., B.S.E.E.
Branch Manager (Quality Assurance), Northrop Corporation
Aeronautical Technology (1972)
- Peter DeCenzo, B.S.
Mathematics Teacher, Ashland High School
Mathematics (1979)
- Richard Deveney, B.A., M.Ed.
Mathematics Instructor, Boston Public Schools
Mathematics (1978)
- Thomas R. Deveney, B.S., M.A.
Basic Skills Coordinator K-12, Boston Public Schools
Mathematics (1965)
- Jane E. DeVoe, B.S., M.A.
Director, Project SEED
Mathematics (1980)
- Douglas H. Diamond, B.E.E.
Program Manager, Analytical Systems Eng. Corp.
Mathematics (1968)
- *Giles C. Dilg, B.S.E.E., M.S.E.E., P.E. (Mass.)
Manager, Honeywell Info. Systems
Engineering Graphics (1966)
- Marie Dolansky, B.S., M.Ed., Ed.D.
Instructor, Mathematics, Northeastern University
Mathematics (1964)
- Mark Domaszewicz, B.E.E., M.S.E.E.
Senior Engineer, Raytheon Company
Electrical Engineering Technology (1970)

**Appointed to the rank of Senior Lecturer*

- Leonard F. Dow, B.S.E.E., M.S., P.E. (Mass.)
Staff Engineer, Boston Edison Company
Electrical Engineering Technology (1970)
- Philip W. Dunphy, B.Sc., M.Ed.
Associate Professor, Cooperative Education, Northeastern University
Academic Counselor (1967)
- *William V. Durante, B.S., M.Ed., M.A.
Assistant Headmaster of Mathematics, Boston Latin School
Course Consultant, Mathematics (1964)
- John A. Ebacher, B.S., M.S.
Mgr., Advanced Engine Systems Analysis, General Electric Co.
Mechanical Engineering Technology (1967)
- Henry B. Eden, B.S.
President, Anco Boston, Inc.
Engineering Graphics (1957)
- David T. Ellis, B.S., M.S.
Engineering Manager, Digital Equipment Corp.
Electrical Engineering Technology (1978)
- Adolf J. Erikson, B.B.A., M.B.A., P.E. (Mass.)
President, A.E. Engineering Corporation
Engineering Graphics (1966)
- *Martin J. Feeney, S.B., Ed.M.
Principal Emeritus, Boston Public Schools
Mathematics (1957)
- Richard Fields, B.S., M.S.
Meteorologist, Minuteman Weather Service
Aeronautical Technology (1980)
- *William D. Finan, A.B., M.A., D.Ed.
Reading Director, Needham Public Schools
Course Consultant, Mathematics (1946)
- *Louis A. Fiore, A.E., B.B.A.
Chief Draftsman, American Science and Engineering, Inc.
Engineering Graphics (1956)
- John M. Flaherty, B.S., M.S., Ph.D.
Advanced R&D Physicist, GTE Sylvania, Inc.
Electrical Engineering Technology (1976)
- *Robert M. Fox, A.S., B.S., M.B.A.
Marketing Manager, Gerber Electronics Inc.
Mathematics (1969)
- *Peter D. Gianino, B.S., M.S.
Research Physicist, R.A.D.C., Hanscom A. F. Base
Course Consultant, Differential Equations (1980)
Mathematics (1965)
- Sheldon L. Glickler, B.S., M.S.
Senior Scientist, Avco Everett Research Laboratory
Civil Engineering Technology (1969)
- *William B. Goggins, Jr., B.S. M.S.E.E., Ph.D.
Staff Member, M.I.T. Lincoln Labs.
Electrical Engineering Technology (1964)
- *David Goldberg, B.S., M.S.E.E., M.S.E.M.
Program Manager, GTE Sylvania
Course Consultant, Engineering Graphics (1969)

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- Bernard F. Goldstein, B.S., M.S., Ph.D.
Senior Analyst, Dynamics Research Corporation
Electrical Engineering Technology (1974)
- Richard J. Grahm, A.B., J.D.
Attorney.
Civil Engineering Technology (1978)
- Norman A. Gray, B.S., M.S., Ph.D.
Mechanical Engineering Technology (1978)
- Forest W. Grumney, B.A., M.B.A.
Corporate Vice President, Human Resources
Mathematics (1963)
- Alan Hadad, B.A., M.A., M.S.
Associate Professor, Wentworth Institute
Mathematics (1979)
- *Francis R. Hankard, S.B., M.A.
Assistant Chief of Lab., Mass. Dept. of Public Safety
Program Consultant, Physics (1946)
- *Joseph J. Hansen, A.B., M.B.A.
Director, Planning Analysis, Raytheon Company
Assoc. Program Consultant, Mathematics (1959)
- *George C. Harrison, B.S., M.S.
Senior Principal Electronic Engineer, Polaroid Corporation
Electrical Engineering Technology (1962)
- Harold Harutunian, A.B., M.A.T., Ed.D.
Assoc. Prof., Salem State College
Mathematics (1965)
- Lewis H. Holzman, B.S.C.E., S.M.C.E., P.E. (Mass.), R.L.S. (Mass.)
Supervisor, Applications Programming, Stone & Webster Eng. Corp.
Computer Technology (1966)
- C. Gregory Hood, B.S., M.A., Ph.D.
Newton Public Schools
Physics (1975)
- Udo Hoppenz, B.S., M.S.
Associate Professor of Physics, Wentworth Institute
Mathematics (1979)
- Charles E. Jacob, B.S.E.E., M.S.Ed., M.L.S.
Master, Boston Latin School
Physics (1967)
- *Perry G. Jameson, B.S., M.Ed.
Asst. Headmaster, Hyde Park High School
Mathematics (1965)
- *Arthur W. John, B.S.E.E., M.S., M.B.A.
Manager of Engineering Training and Administration, Data General Corp.
Physics (1968)
- Eugene F. Joyce
Technician, Electrical Engineering Dept., Northeastern University
Electrical Engineering Technology (1963)
- *John Kaczorowski, Jr., B.S.E.E., M.S.E.E.
Associate Dean of Instruction, Wentworth Institute
Assoc. Program Consultant, Electrical Engineering Technology (1970)
- *Leon Katler, Certificate P.E. (Mass., Maine, N.Y., Pa., Va.)
Senior Structural Engineer, Stone & Webster Eng. Corp.
Civil Engineering Technology (1963)

*Appointed to the rank of Senior Lecturer

- Phillip T. Karatzas, B.S., M.S.
Nuclear Technology Engineer, Stone & Webster Eng. Corp.
Physics (1978)
- *Louis Katona, B.C.E., M.C.E., P.E. (Mass., N.Y.)
Senior Hydraulic Engineer, Badger America, Inc.
Civil Engineering Technology (1959)
- Sidney W. Kaye, B.Sc., M.Ed.
Senior Engineer, Raytheon Company
Mathematics (1967)
- *George F. Kent, B.S., M.S., P.E. (Mass.)
Senior Power Engineer, Stone & Webster Eng. Corp.
Course Consultant, Materials (1962)
- Bernard J. Kiley, B.E., M.E., P.E. (N.H., Mass., Conn.)
Senior Structural Engineer, Stone & Webster Eng. Corp.
Mechanical Engineering Technology (1958)
- *John J. Klein, B.S., M.S.
Manager, Design Engineering, Radio Corporation of America
Electrical Engineering Technology (1950)
- Joseph C. LaCroix, B.A., M.Ed., C.A.G.S.
Chairman of Math. Dept., Dorchester High School
Mathematics (1974)
- *Robert S. Lang, B.S., Ed.M.
Associate Professor, Industrial Engineering and Information Systems, Northeastern University.
Program Consultant, Engineering Graphics (1955)
- Philip J. Laurens, B.S., M.S.
Instructor, Mass. Bay Community College
Mathematics (1974)
- Carl Leone, Jr., A.B., M.S.
Coord. of Athletics and Transportation, Quincy Public Schools
Mathematics (1965)
- A. Richard LeSchack, A.B., A.M.
Applied Mathematician, The Analytical Science Corp.
Mathematics (1968)
- Alvin J. Lesieur, B.S., M.Ed.
Instructor, Braintree High School
Engineering Graphics (1965)
- Sandra M. Lictor, B.S.Ed., M.Ed.
Instructor, Lynn English High School
Mathematics (1967)
- *Demetre P. Ligor, B.S.E.E., P.E. (Mass.)
President, Applied Measurements, Inc.
Course Consultant, Physics (1959)
- Warren J. Little, B.S., M.S.
Technical Staff, Charles Stark Draper Labs., Inc.
Physics (1966)
- George M. Livingstone, Jr., B.S.
Private Practice
Civil Engineering Technology (1975)
- *Andrew G. Lofgren, A.A., Ed.M., P.E. (Mass.)
Self Employed; Consultant and Lecturer on ANSI-Y14.5
Mechanical Engineering Technology (1946)
- Bertram S. Long
Associate Prof. Mechanical Eng., Northeastern University
Assoc. Program Consultant, Mechanical Engineering Technology (1975)
- *Appointed to the rank of Senior Lecturer

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- *Roger G. Long, A.E., B.B.A., P.E. (Mass.)
Senior Staff, Arthur D. Little
Electrical Engineering Technology (1952)
- *Kenneth A. Lucas, B.S., M.Ed., P.E. (Mass., Conn.) R.L.S. (Mass., Conn., Maine, N.H.)
Director, E.M.A.L.S. School of Survey
Civil Engineering Technology (1950)
- John F. Lutkevich, A.E., B.B.A.
Engineer in Charge, GTE Sylvania
Engineering Graphics (1956)
- *Alan A. Mackey, B.S., M.A.
Acting Dean of Continuing Education, Northeastern University
Mathematics (1952)
- Jack I. Mann, B.S.C.E., M.S., P.E. (Mass., Conn., Pa., Vt., Wyoming)
Chief Engineer, General Engineering, United Eng. & Constr. Inc.
Mechanical Engineering Technology (1960)
- Deborah D. Mason, B.S., Sc.M.
Engineer, Polaroid Corporation
Mechanical Engineering Technology (1980)
- Anton Mavretic, B.S., M.S., Ph.D.
Associate Professor, Boston University
Assoc. Program Consultant, Electrical Engineering Technology (1969)
- *Edward McCarren, Jr., A.E.
Product Engineer, Analog Devices, Inc.
Electrical Engineering Technology (1951)
- *Carl J. Mellea, S.B., M.S., P.E. (Mass., R.I., Maine, Vt., N.H.)
Project Engineer, Howard, Needles, Tammen & Bergendorff
Civil Engineering Technology (1960)
- Robert L. Meserve, B.S., M.S.
Assoc. Professor, Civil Engineering, Northeastern University
Civil Engineering Technology (1978)
- *Walter Messcher, B.M.E., M.S.
Project Manager, U.S. Department of Transportation
Program Consultant, Computer Technology (1966)
- Richard W. Miller, B.S., M.S., P.E. (Mass.)
Principal Research Engineer, The Foxboro Company
Mechanical Engineering Technology (1959)
- *Ernest E. Mills, B.S., M.S., P.E. (Mass.)
Program Coordinator of Mechanical Engineering Technology and
Associate Professor of Mechanical Engineering Technology
Lincoln College, Day and Evening Programs (1946)
- Louis A. Moore, A.E., B.E.T., B.S.C.E., R.L.S. (Mass.)
Deputy Engineer, Commonwealth of Mass., Land Court, Boston
Civil Engineering Technology (1972)
- *Louis J. Nardone, B.S., M.S., P.E. (Mass.)
Associate Professor, Electrical Engineering Tech., Northeastern Univ.
Program Coordinator for Electrical Engineering Technology
Lincoln College, Day and Evening Programs (1955)
- Stephen N. Niers, B.S.
Consultant, Bremer Associates, Inc.
Computer Technology (1977)
- Robert L. Norton, A.S., B.S., M.S., P.E. (Mass.)
Senior Engineer, Polaroid Corporation
Computer Technology (1967)

*Appointed to the rank of Senior Lecturer

- *Ray O. Oglesby, B.S.Ed., M.S.Ed.
Teacher, Newton North High School
Mathematics (1967)
- Yesugey Oktay, B.S., M.S., P.E. (Mass., N.Y., Cal., Me.)
Project Manager, Boston Edison Company
Civil Engineering Technology (1970)
- Peter J. O'Neill, A.B., M.A.T.
Mathematics Instructor, Norwood High School
Mathematics (1977)
- Douglas J. Ordway, B.A., M.Ed.
Teacher, Boston Public Schools
Mathematics (1975)
- *Thomas J. Owens, A.B., M.Ed.
Instructor in Mathematics, Quincy High School
Mathematics (1952)
- John P. Page, A.B., M.Ed., A.M.
Teacher of Mathematics, Boston Latin School
Mathematics (1980)
- *William H. Parmenter, A.E., B.B.A.
Instructor, Newton North High School
Electrical Engineering Technology (1952)
- Francis A. Pepicelli, A.E., B.S.
Engineer, Northrop Corporation
Mechanical Engineering Technology (1976)
- Peter J. Philliou, B.S., M.S., J.D.
Director, Curriculum Center, Wentworth Institute
Mathematics (1967)
- Walter J. Phinney, A.E., B.E.T., M.B.A.
Manager, Product Design, Raytheon Company
Mechanical Engineering Technology (1977)
- Dominic A. Piccione, B.S., M.S.P.E. (Mass., Va.)
Senior Engineer, Stone & Webster Eng. Corp.
Mechanical Engineering Technology (1966)
- *Norman C. Poirier, B.S., M.S., P.E. (Mass.)
Research Associate, Northeastern University
Electrical Engineering Technology (1966)
- Donald J. Poulin, A.E., B.S.I.T., P.E. (Mass.)
Sr. Test Eng., Kollsman Inst., Merrimack, New Hampshire
Electrical Engineering Technology (1970)
- *Daniel W. Pratt, B.S., M.S.
Director of Computer Science, Boston Latin School
Mathematics (1967)
- *Charles H. Price, Jr., B.S., M.S.
Technical Staff, The Mitre Corporation
Course Consultant, Electrical Engineering Technology (1960)
- William B. Pronk
Chief Flight Instructor, Wiggins Airways
Aeronautical Technology (1972)
- Andrea Quintiliani, B.S., M.S.
Mathematics Instructor, Massasoit Community College
Mathematics (1978)
- Richard A. Radville, B.S.A.D., M.Arch.
Project Architect, The Architects Collaborative, Inc.
Civil Engineering Technology (1980)

*Appointed to the rank of Senior Lecturer

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Robert Rancourt, B.S., M.S.
Staff Engineer, ASEC
Mathematics (1977)

James F. Regan, B.S., M.S., P.E. (Mass.)
President, Keefe & Regan Engineers, Inc.
Civil Engineering Technology (1972)

*Edward L. Rich, B.S., M.S., P.E. (Mass.)
Program Control Manager, Raytheon Company
Mechanical Engineering Technology (1956)

Eric A. Roy, A.B., M.Ed., M.A.
Assistant Headmaster, Jamaica Plain High School
Mathematics (1967)

Thomas E. Ruden, B.S., M.S.
Physicist, Varian Associates, Inc.
Physics (1967)

*Thaddeus Sadowski, S.B., Ed.M.
North Quincy High School
Mathematics (1958)

*Leo D. Salvucci, A.B., M.Ed., M.S.T.
Math. Teacher, Boston Latin School
Mathematics (1965)

Richard P. Samuels, B.E.E., M.S.I.M., P.E. (Mass.)
New England Telephone
Mathematics (1970)

Engenio Sartori, M.S., Ph.D.
Staff Engineer, Charles Stark Draper Labs., Inc.
Electrical Engineering Technology (1977)

Charles A. Schuetz, A.B., M.Ed.
Assistant Principal, Don Bosco Technical High School
Physics (1980)

*Henry Schwartz, A.B., M.Ed., P.E. (Mass.)
Chief Engineer, CA-PRA Inc.
Physics (1958)

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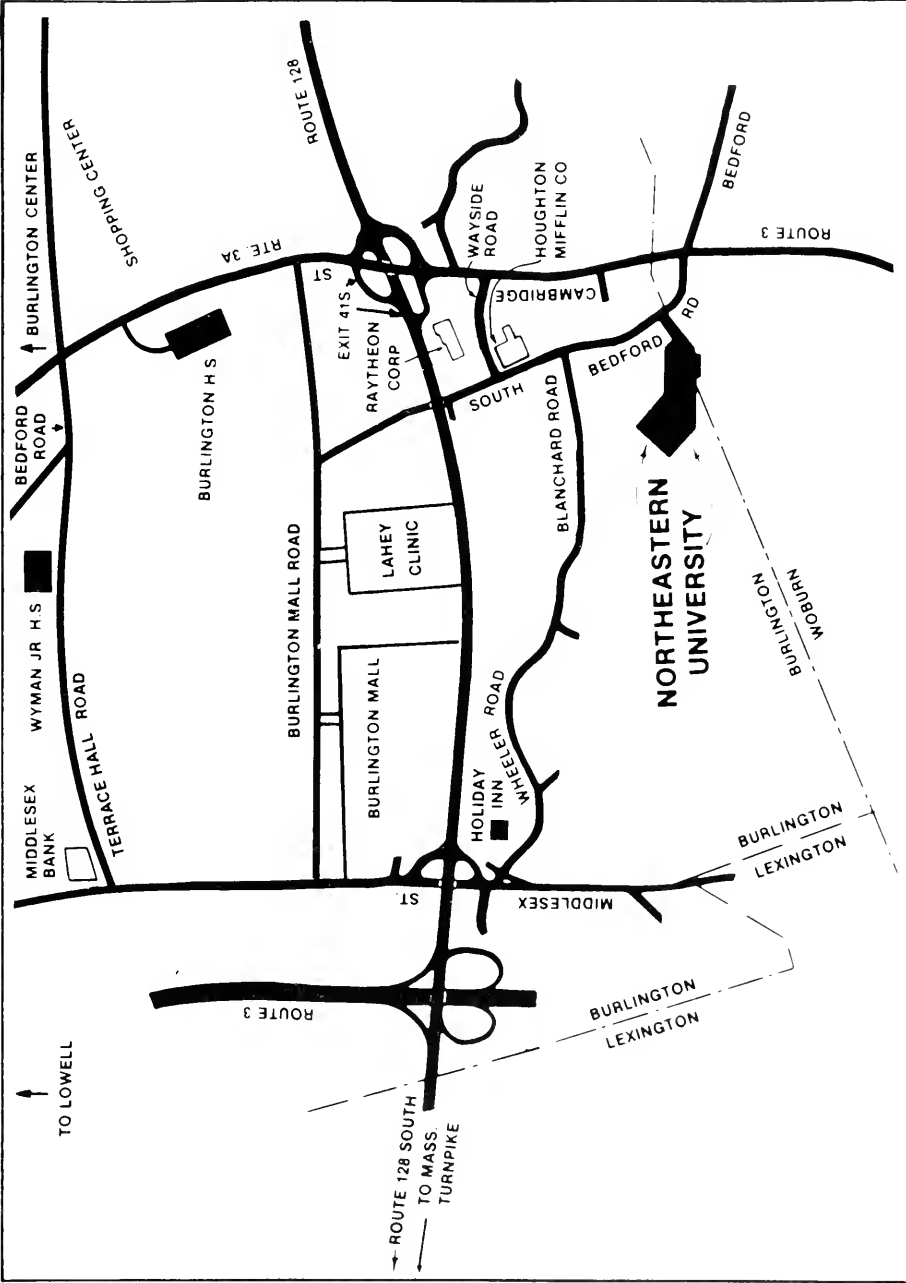
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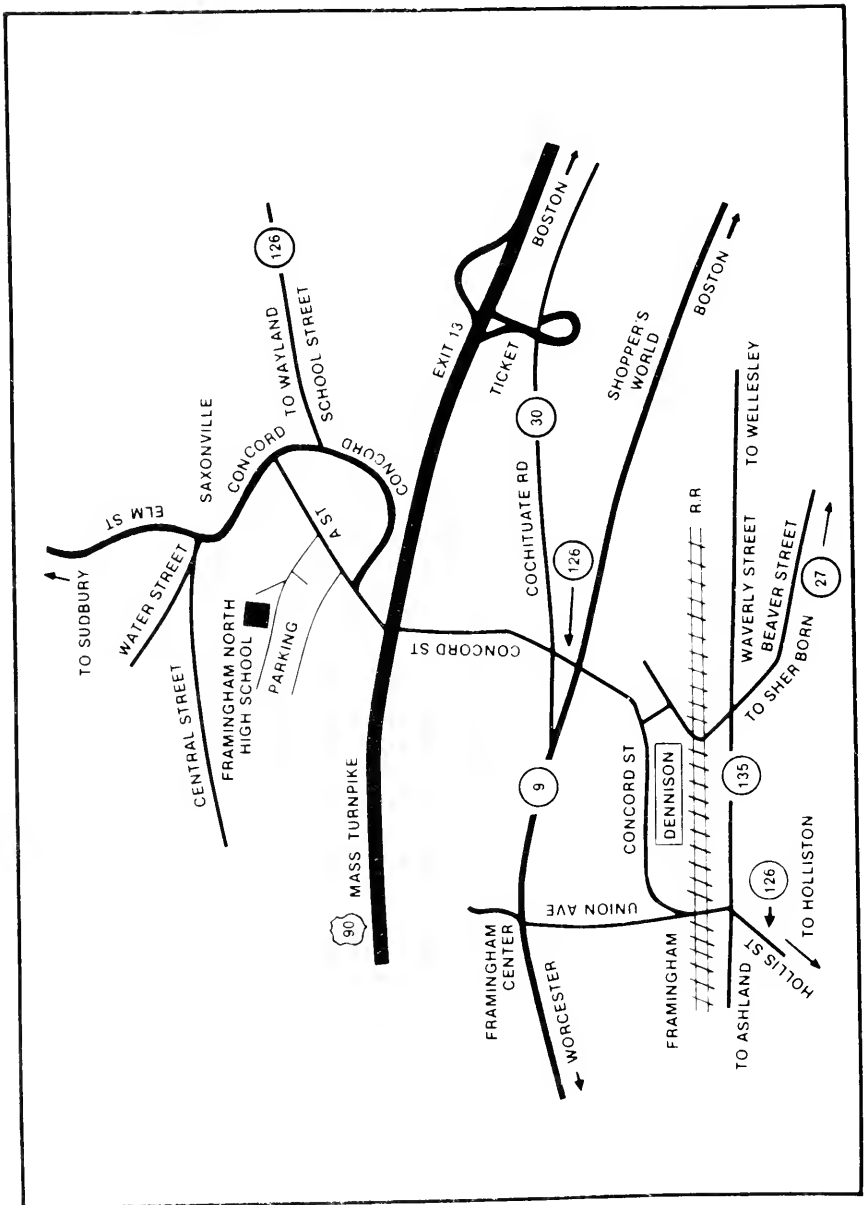
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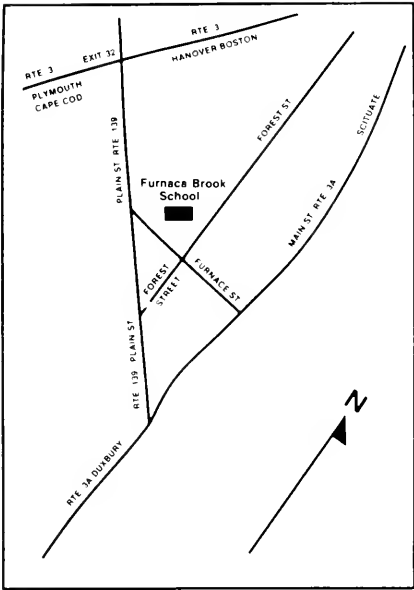
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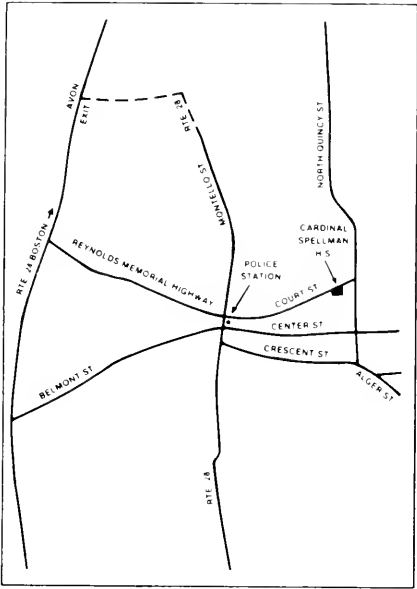
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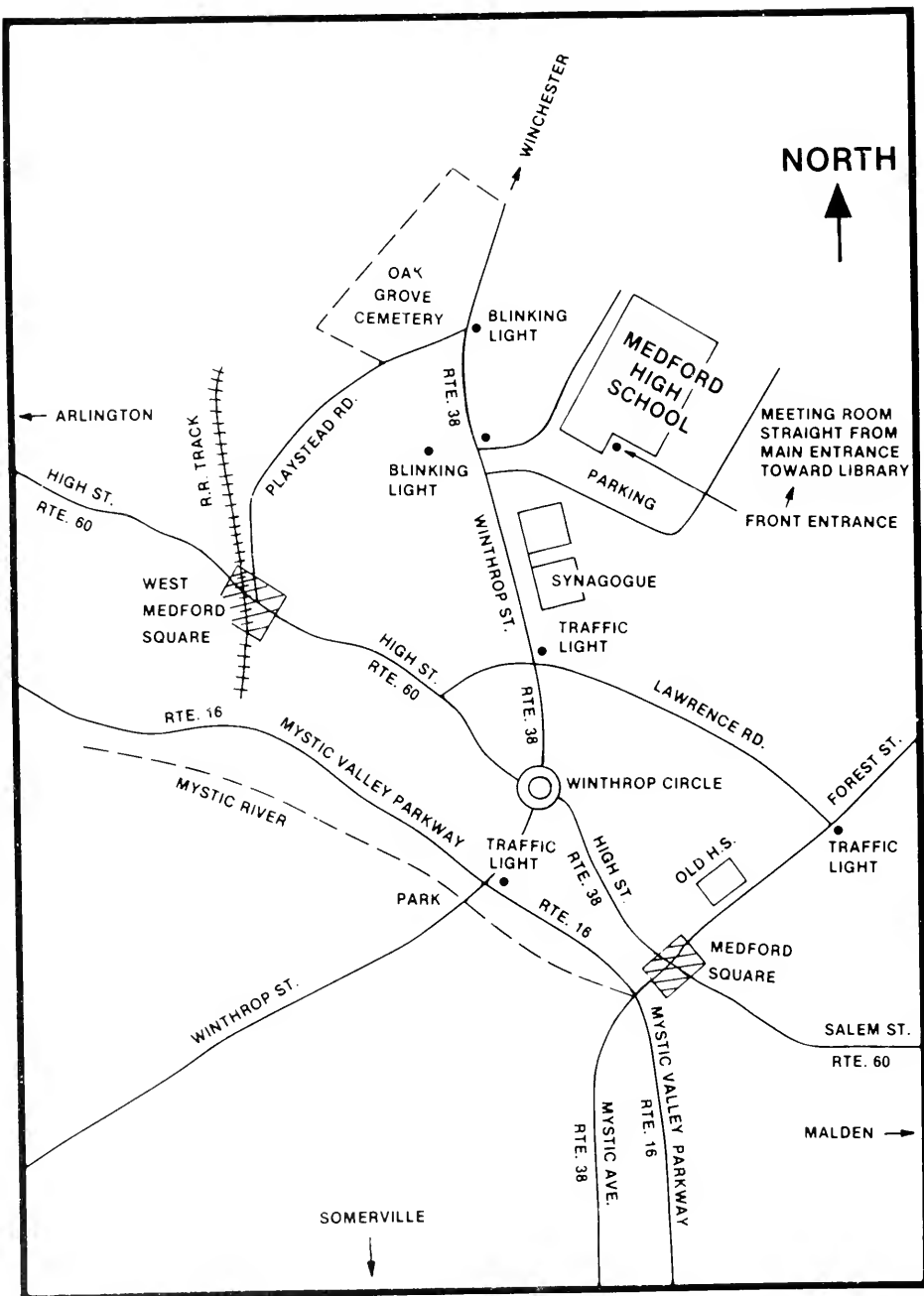
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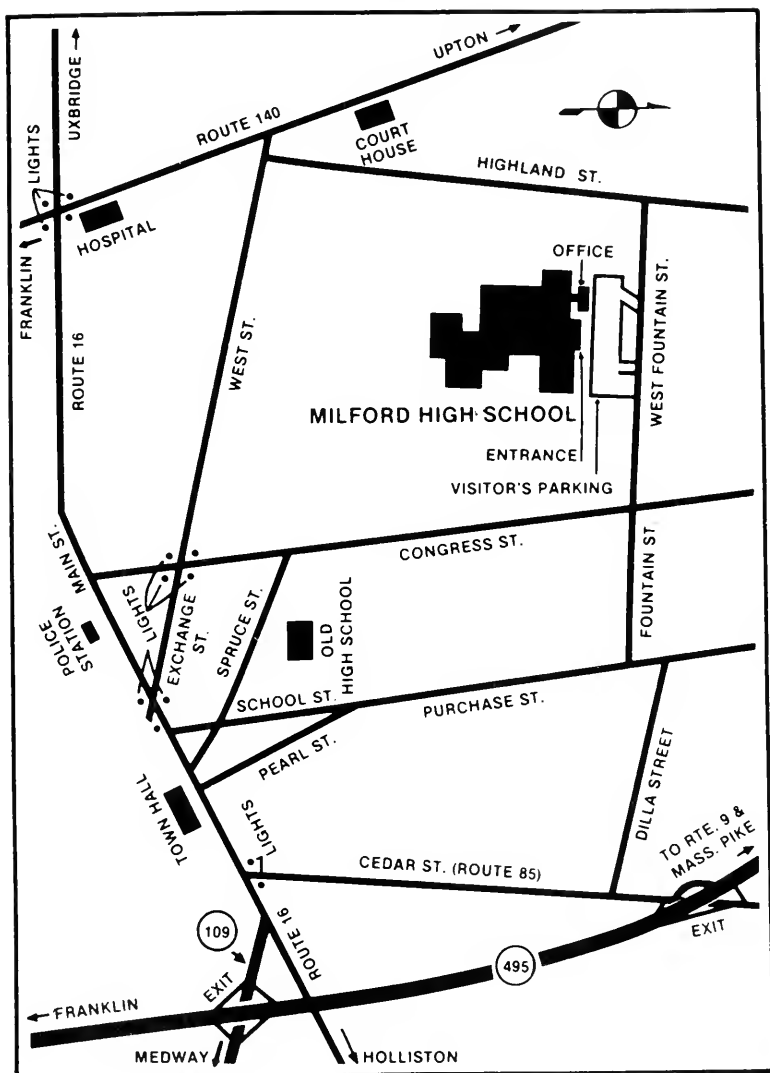
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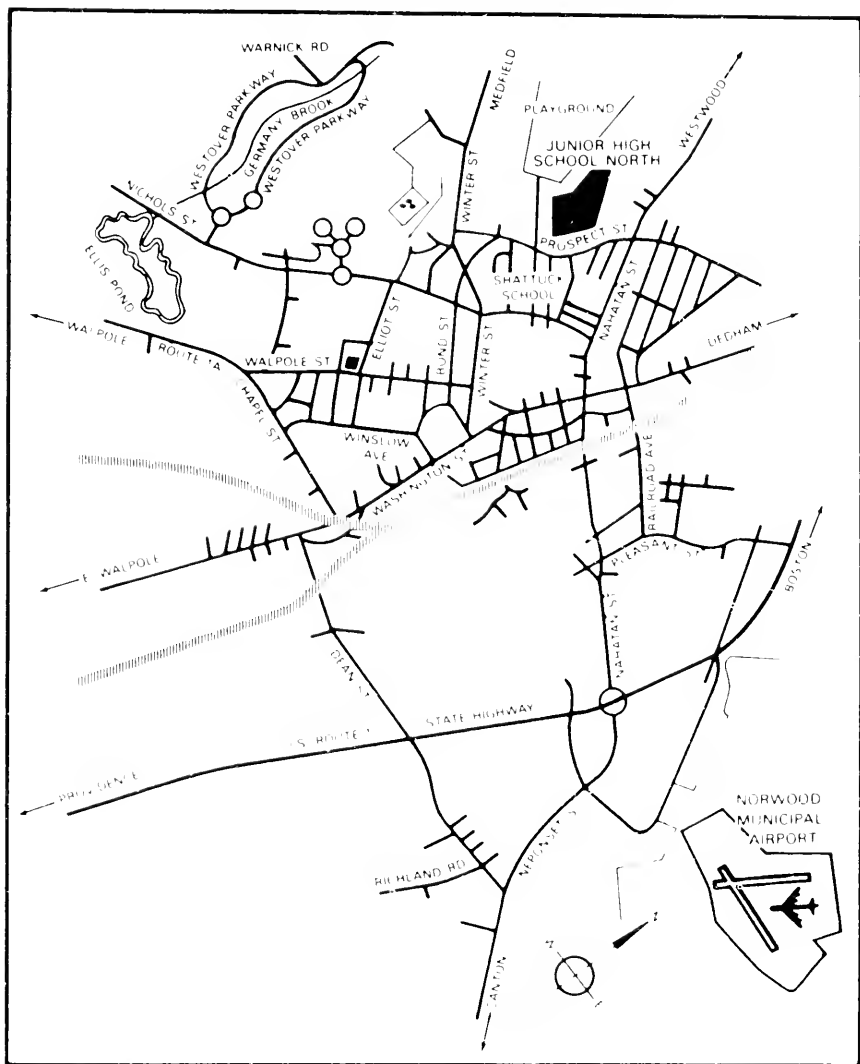
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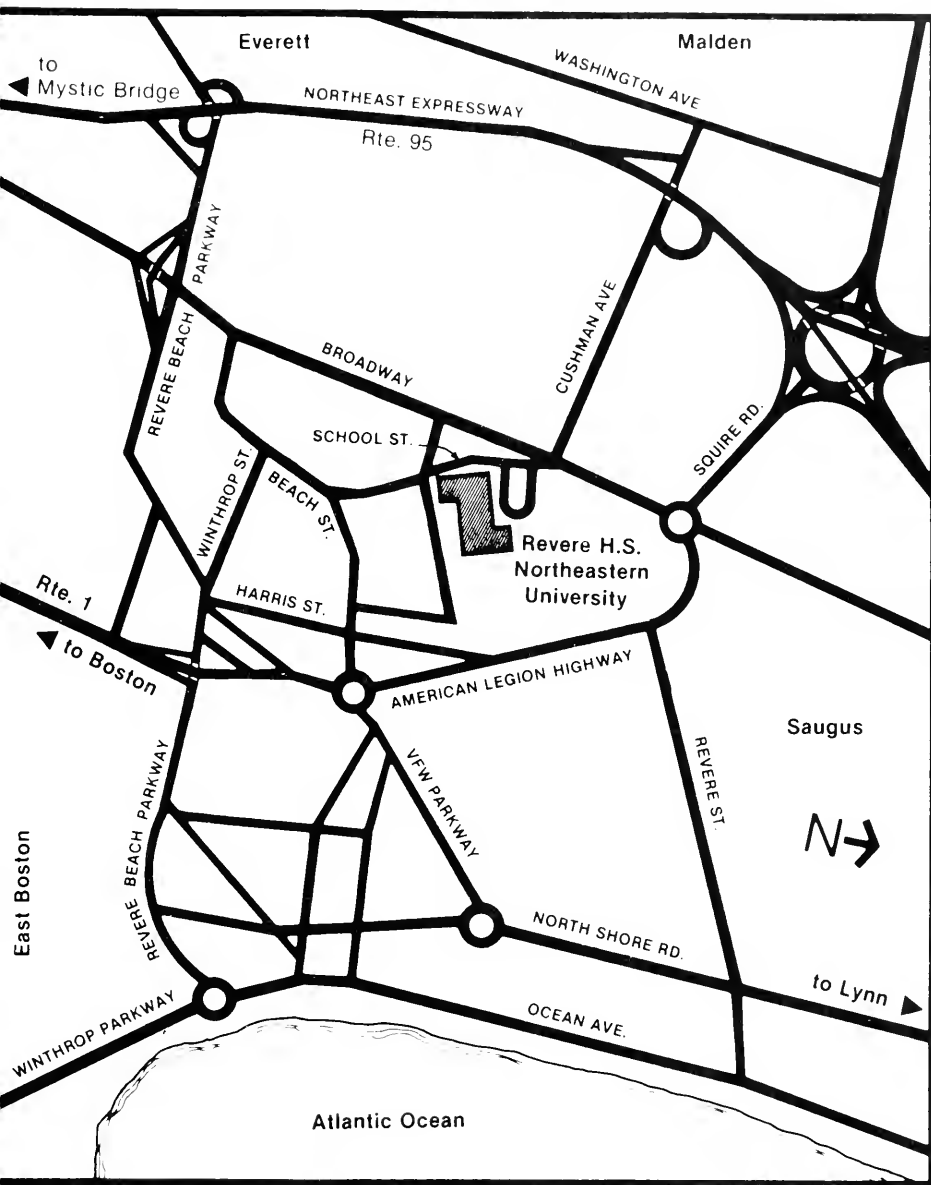
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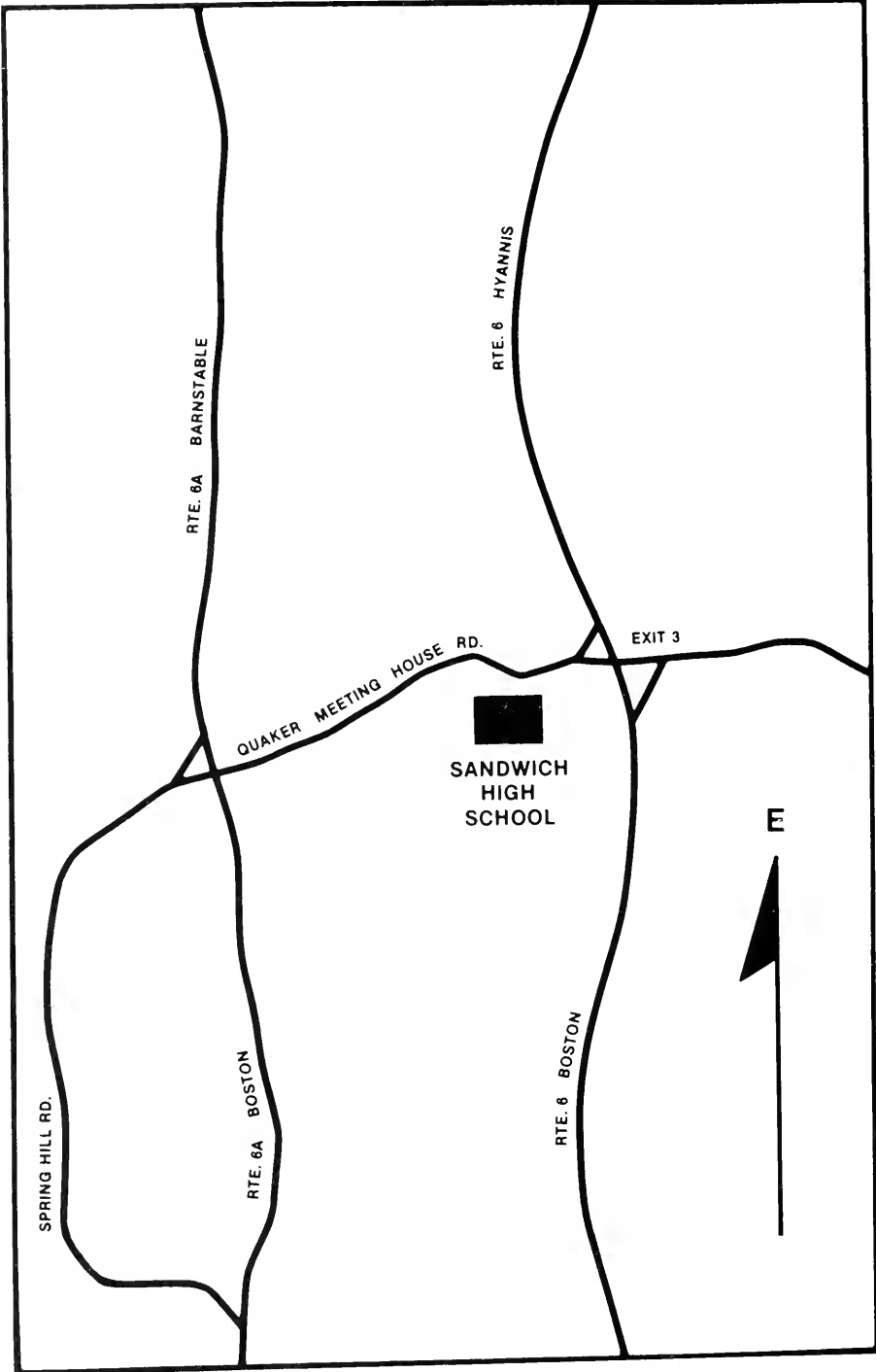
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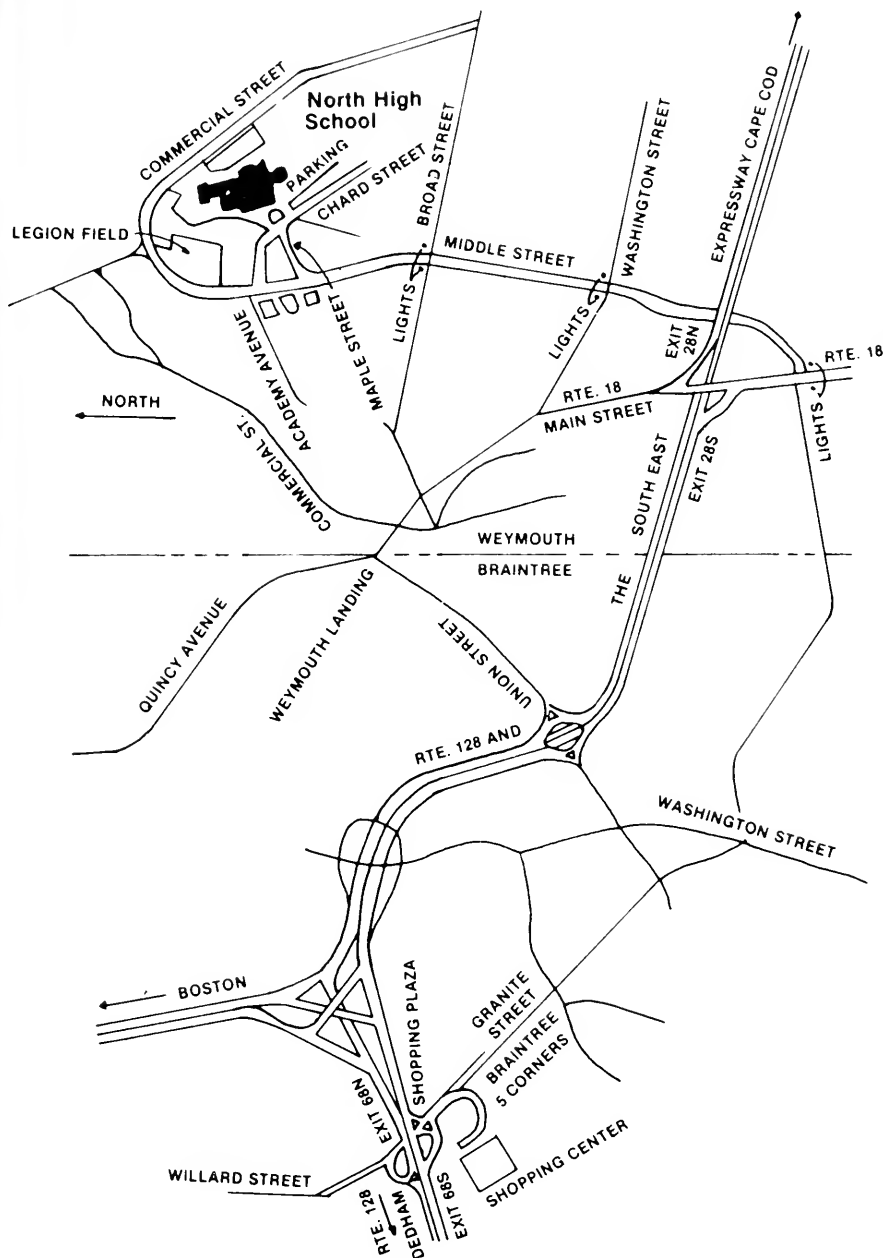
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